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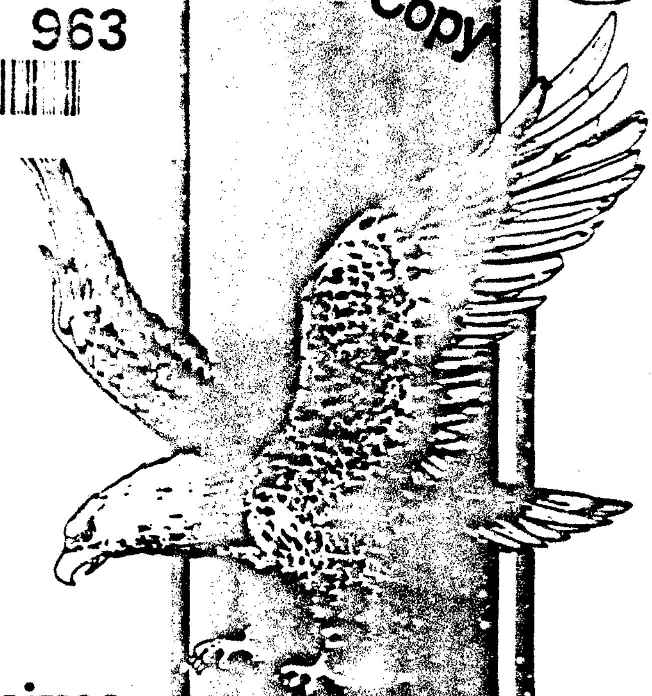
Appendices



USATHAMA

U.S. Army Toxic and Hazardous Materials Agency

Task Order - 2
Pilot Test of Hot Gas Decontamination of Explosives-Contaminated Equipment at Hawthorne Army Ammunition Plant (HWAAP) Hawthorne, Nevada

Report No. CETHA-TE-CR-90036

July 1990

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INTRODUCTION TO APPENDICES

The following appendices are included in this report:

Appendix A - Description of Spiking Procedures

Appendix B - Sampling and Analytical Methods

Appendix C - Description of CEM System

Appendix D - Raw Operational Data Sheets

Appendix E - Hourly Averages for CEM System Data

Appendix F - Raw Analytical Data Sheets for Test Items

Appendix G - Analytical Data Summary Tables for Stack Test Program

Appendix H - Analytical Data Summary Tables for Test Items

Appendix I - Example Calculations

Breaker pages are provided to identify each appendix listed above. A brief summary is included at the beginning of each appendix describing the contents.

APPENDIX A

DESCRIPTION OF SPIKING PROCEDURES

A. Description of Spiking Procedures

A description of the spiking procedures is discussed in the following subsections. Sparkless equipment was used when preparing and applying the spike solutions. WESTON personnel, in conjunction with HWAAP laboratory personnel, prepared the liquid spike solutions. HWAAP laboratory personnel prepared the paste spike solutions. HWAAP laboratory personnel applied all spike liquid/paste solutions.

A.1 TNT spiking procedures. A homogenous liquid solution (i.e., no solid TNT) was used to spike the following items of equipment:

- powder boxes
- steam-heated risers
- steam-heated discharge valves
- steel pipe
- aluminum pipe

Prior to spiking, a batch solution was made to spike all test equipment. One hundred grams of TNT were added to 250 mL of acetone; 25 mL of the homogenous solution were added to the test equipment outlined above (using a pipet). After adding the solution to the equipment, the pipet was flushed with acetonitrile to remove residual TNT. The rinsate was added to the equipment. This resulted in a spike of 10 grams of TNT for each piece of equipment.

The liquid spike solution was added directly into the powder boxes. The boxes were agitated to swirl the liquid, exposing it to the internal surfaces. Holes or cracks in the powder boxes were plugged with parafilm wax.

For steam-heated vessels (risers and discharge valves), the bottom steam connection was covered with parafilm wax. Although it was originally planned to use rubber stoppers, parafilm was used to avoid potential analytical interference associated with rubber products. The spike solution was added to the upper steam connection. The vessel was agitated to swirl the liquid and expose it to the internal surfaces.

For pipe (aluminum and steel), one end of the pipe section was covered with parafilm wax. Spike solution was added into the open end of the pipe. The pipe was agitated to swirl the liquid, exposing it to the internal surfaces.

A heterogenous mixture (i.e., a workable paste) was used to spike the support racks for shells. For the TNT spike, 1 gram of TNT was mixed with about 0.8 mL of acetone. Although it was originally planned to spike shell support racks with 10 grams of TNT, field operations indicated that 1 gram was sufficient to cover the spike area (4 inches by 4 inches) adequately. The mixing container and applicator (spatula) were rinsed with about

50 mL acetonitrile. The rinsate was collected for analysis to determine the amount of TNT that adhered to the container and applicator.

The spiked equipment was placed on the loading dock of Building 117-15 and allowed to air dry.

A.2 Ammonium picrate spiking procedures. A homogenous liquid solution (i.e., no solid ammonium picrate) was used to spike the following items of equipment:

- o powder box
- o steam-heated riser
- o steam-heated discharge valve
- o steel pipe
- o aluminum pipe

Prior to spiking, a batch solution was made to spike all test equipment. Forty grams of ammonium picrate were added to 2400 mL of acetone; 300 mL of the homogenous solution were added to the test equipment outlined above (using a pipet). After adding the solution to the equipment, the pipet was flushed with water to remove residual ammonium picrate. The rinsate was added to the equipment. This resulted in a spike of 5 grams of ammonium picrate for each piece of equipment.

The procedures for spiking with ammonium picrate are the same as those used for spiking with TNT (for each type of equipment).

A.3 Spike recovery procedures. As outlined in the Test Plan, it was originally planned to conduct spike recovery tests. Selected pieces of test equipment were to be spiked with TNT and ammonium picrate. The spiked equipment was to be sampled (wipe samples or rinsates) to determine the efficiency of the sampling methods. During spiking activities, however, it was determined that it would never be possible to fully recover the TNT or ammonium picrate spiked on the equipment. Residual levels of explosives on the parafilm, steam connections, etc. interfered with recovery. Therefore, based on conversations with USATHAMA personnel, it was decided to conduct multiple rinses on the treated test equipment rather than on spiked equipment. Treated equipment was sampled using a series of four rinses.

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APPENDIX B

SAMPLING AND ANALYTICAL METHODS

Appendix B provides a description of the following Sampling and Analytical Methods:

- EPA Method 1 - Sample and velocity traverses for stationary sources. (Page B-1)
- EPA Method 2 - Determination of stack gas velocity and volumetric flow rate. (Page B-5)
- EPA Method 25A - Determination of total gaseous organic concentration using a flame ionization analyzer. (Page B-17)
- EPA Method 3 - Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight. (Page B-19)
- EPA Method 10 - Determination of carbon monoxide emissions from stationary sources. (Page B-21)
- EPA Method 4 - Determination of moisture content in stack gases. (B-25)
- EPA Wipe Sampling Technique (Page B-29)
- Modified Method LW02 - Analysis of explosives in soil, wipe, and rinsate samples. (Page B-33)
- Modified Method for nitrocellulose, nitroglycerin, and PETN in water. (Page B-45)
- Ammonium Picrate in water and wipe samples by high performance liquid chromatography. (Page B-49)
- EPA Modified Method 5 - Modified method 5 sampling train. (Page B-55)
- EPA Method 5 - Determination of particulate emissions from stationary sources. (Page B-105)
- EPA Method 3A - Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources. (Page B-119)
- EPA Method 7E - Determination of nitrogen oxide emissions from stationary sources. (Page B-123)

Section 7 of the main report provides a summary of the sampling and analytical methods used to evaluate test items and air samples. The locations of the sampling points are shown in Figure 7-1 of the main report. A summary of the analytical parameters associated with each point is presented in Table 7-1 of the main report.

EPA METHOD 1

SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

METHOD 1—SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4), (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m² (113 in.²) cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. *Procedure*

2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2LW}{(L+W)}$$

where L=length and W=width.

An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This procedure, determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.); (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).

When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

TABLE 1-1 CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

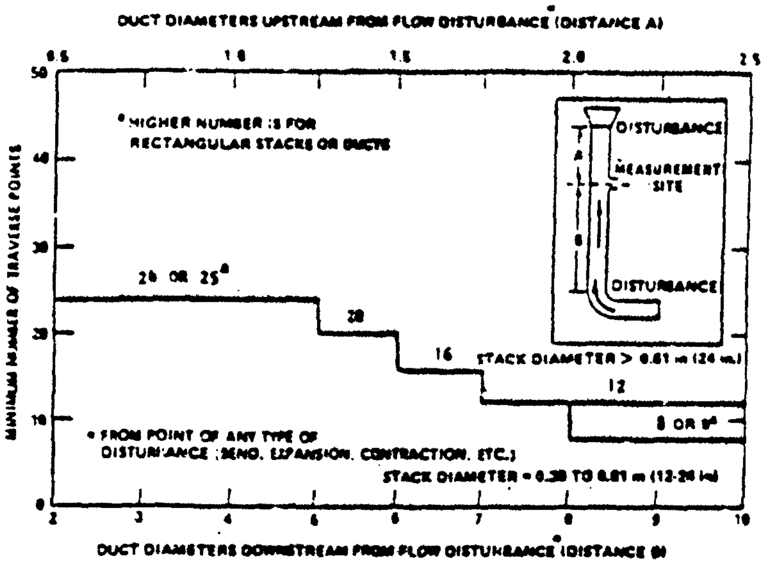

Figure 1-1. Minimum number of traverse points for particulate traverses.

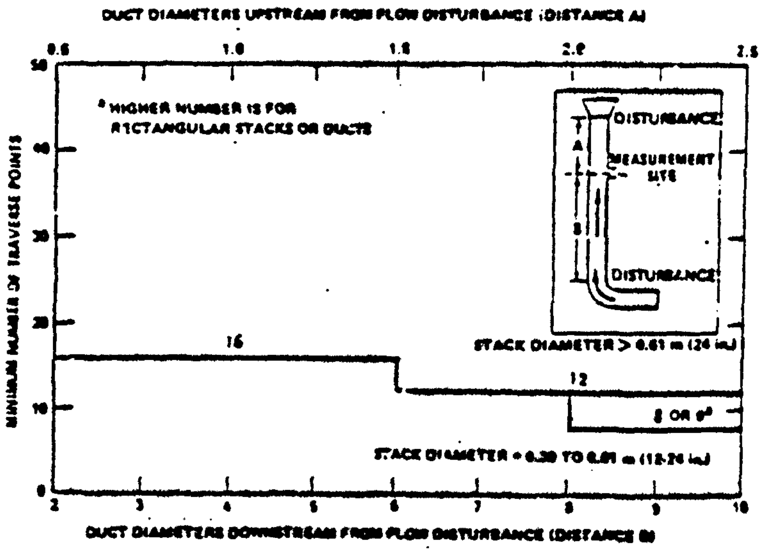

Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.

2.3 Cross-sectional Layout and Location of Traverse Points.

2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator.

In addition for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.

2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points.

Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

TRAVERSE POINT	DISTANCE, % of diameter
1	4.4
2	14.6
3	29.6
4	70.4
5	85.4
6	95.6

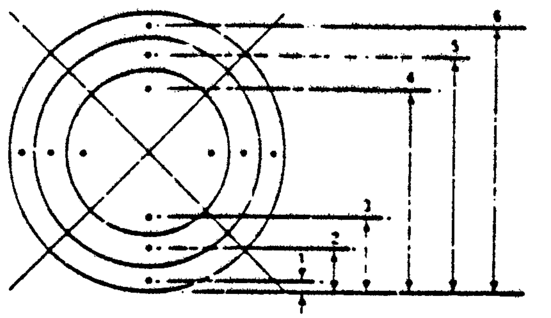

Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter— 2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	2.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.

If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4x3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9x4 or 12x3, and would not necessarily have to be 6x6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area.

The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.

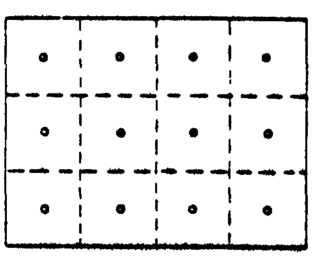

Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to ±90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses.

The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above. The limit of acceptability for the average value of α would remain 20°.

2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than ½ duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation.

Note.—Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.

2.5.1 Apparatus.

2.5.1.1 Directional Probe. Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (Note: Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional probe, and permanently mark or engrave the number on the body of the probe. The pressure holes of directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "back-purging" with pressurized air is required.

2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., magnehelic gauges) that meet the specifications described in Method 2, § 2.2.

Note.—If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, § 2.2.

2.5.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow § 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location is determined to be acceptable according to the criteria in this alternative procedure, use the same traverse point number and locations for sampling and velocity measurements.

2.5.3 Measurement Procedure.

2.5.3.1 Prepare the directional probe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H_2O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.

2.5.3.2 Level and zero the manometers. Since the manometer level and zero may drift because of vibrations and temperature changes, periodically check the level and zero during the traverse.

2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibration curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point.

A post-test check as described in § 2.5.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, and repeat the flow angle measurements.

2.5.4 Calculate the resultant angle at each traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculations retaining at least one extra significant figure beyond that of the acquired data. Round the values after the final calculations.

2.5.4.1 Calculate the resultant angle at each traverse point:

R_i = arc cosine [(cosine Y_i)(cosine P_i)] Eq. 1-2

Where:

R_i = Resultant angle at traverse point i, degree.

Y_i = Yaw angle at traverse point i, degree.

P_i = Pitch angle at traverse point i, degree.

2.5.4.2 Calculate the average resultant for the measurements:

$$\bar{R} = \frac{\Sigma R_i}{n} \quad \text{Eq. 1-3}$$

where:

$\bar{R}$ = Average resultant angle, degree.

n = Total number of traverse points.

2.5.4.3 Calculate the standard deviations:

$$S_d = \sqrt{\frac{\sum_{i=1}^{n} (R_i - \bar{R})^2}{(n-1)}} \quad \text{Eq. 1-4}$$

Where:

S_d = Standard deviation, degree.

2.5.5 The measurement location is acceptable if $\bar{R} < 20°$ and $S_d < 10°$.

2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3600 ft/min).

2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurements should be made at the same point in the test section, preferably at the centroid of the test-section.

2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be ± 2° of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.

2.5.6.3 Pitch Angle Calibration. Perform a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from −60° to +60° at one velocity in each of the two ranges specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured data values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and 60°.

2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows. Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-demensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.

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EPA METHOD 2

DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

METHOD 2—DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

1. *Principle and Applicability*

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. *Apparatus*

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g. stainless steel). It is recommended that the external tubing diameter (dimension D_t, Figure 2-2b) be between 0.48 and 0.95 centimeters (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B, Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

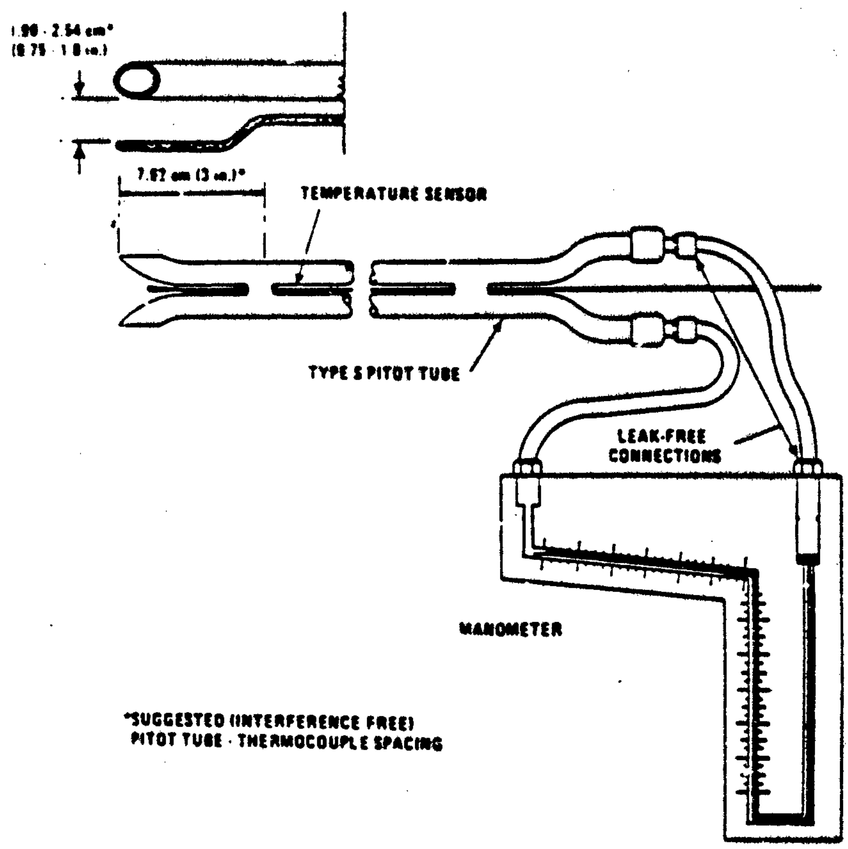


Figure 2-1. Type S pitot tube manometer assembly.

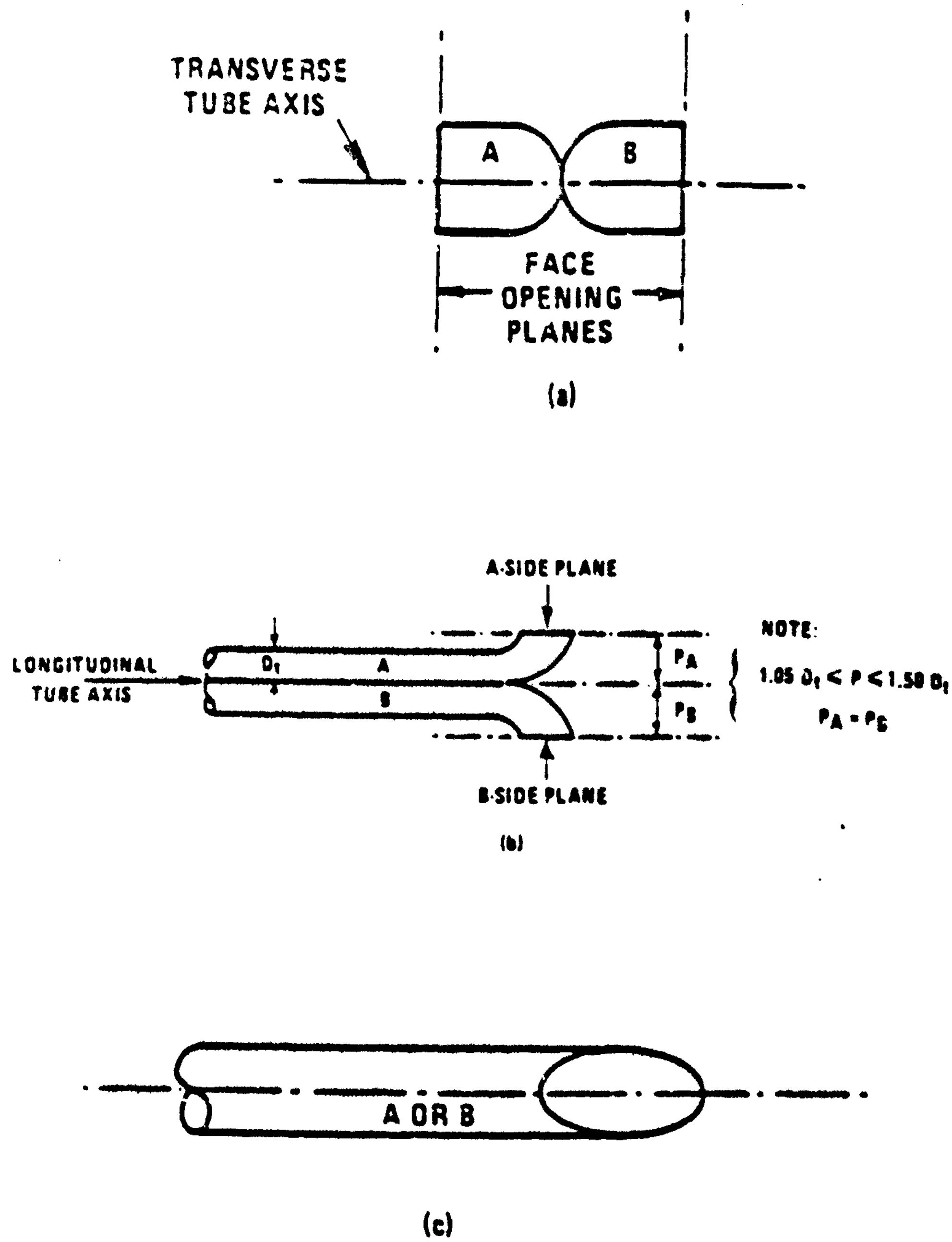


Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

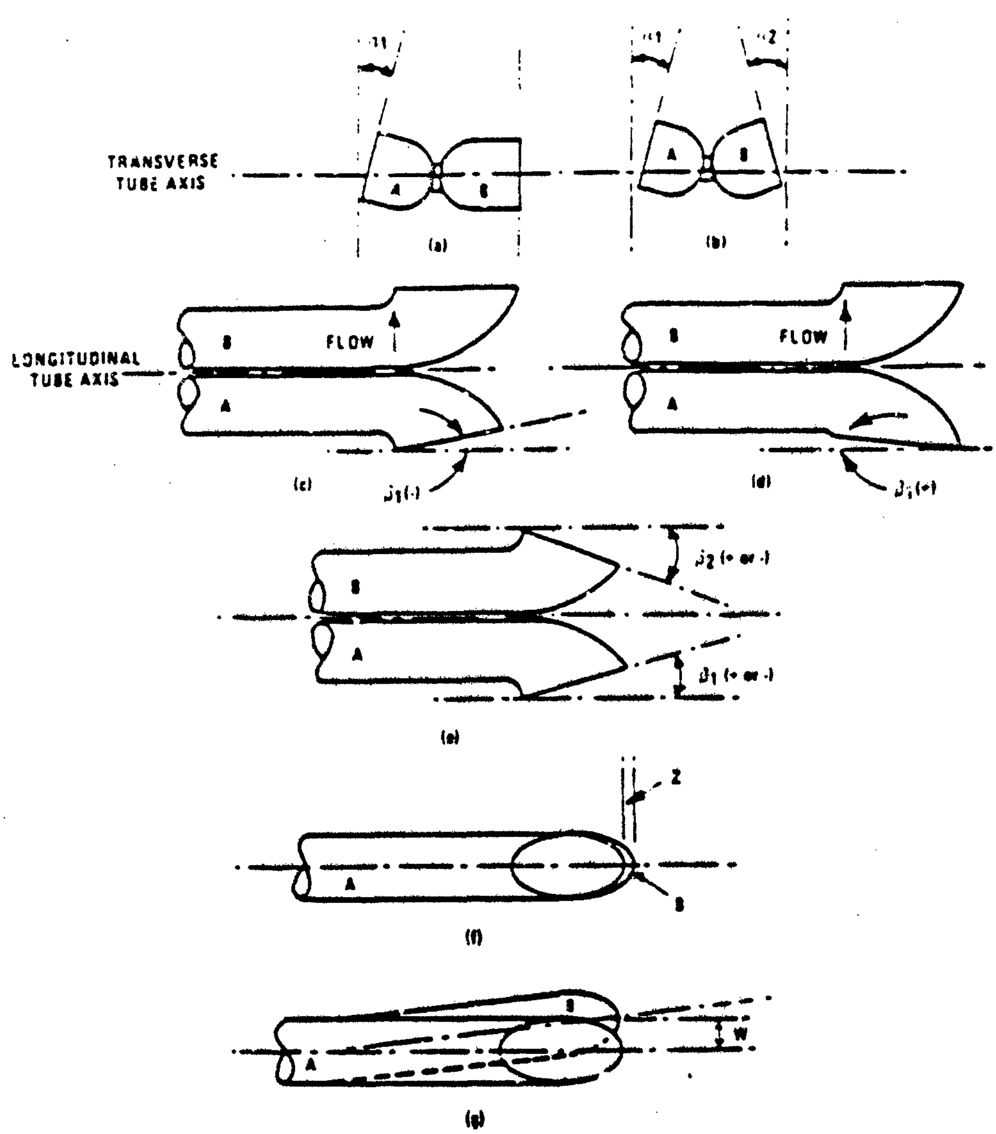


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of Cp(s) so long as $\alpha 1$ and $\alpha 2$ 10°, $\beta 1$ and $\beta 2$ 5°, z 0.32 cm (1/8 in.) and w 0.08 cm (1/32 in.) (citation 11 in Section 6).

A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same (± 5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be

taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0-to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T = \frac{\sum_{i=1}^{n} \sqrt{\Delta p_i + K}}{\sum_{i=1}^{n} \sqrt{\Delta p_i}}$$

where:

Δp_i = Individual velocity head reading at a traverse point, mm H_2O (in. H_2O).

n = Total number of traverse points.

K = 0.13 mm H_2O when metric units are used and 0.005 in H_2O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

Note: If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge, capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vice-versa for elevation decrease.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99±0.01.

2.7.1 Hemispherical (shown in Figure 2-4), ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.

2.7.5 Ninety degree bend, with curved or mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O). For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in H_2O) for Δp values between 1.3 and 25 mm H_2O (0.05 and 1.0 in. H_2O), and to the nearest 1.3 mm H_2O (0.05 in. H_2O) for Δp values above 25 mm H_2O (1.0 in. H_2O). A special, more sensitive gauge will be required to read Δp values below 1.3 mm H_2O [0.05 in. H_2O] (see Citation 18 in Section 6).

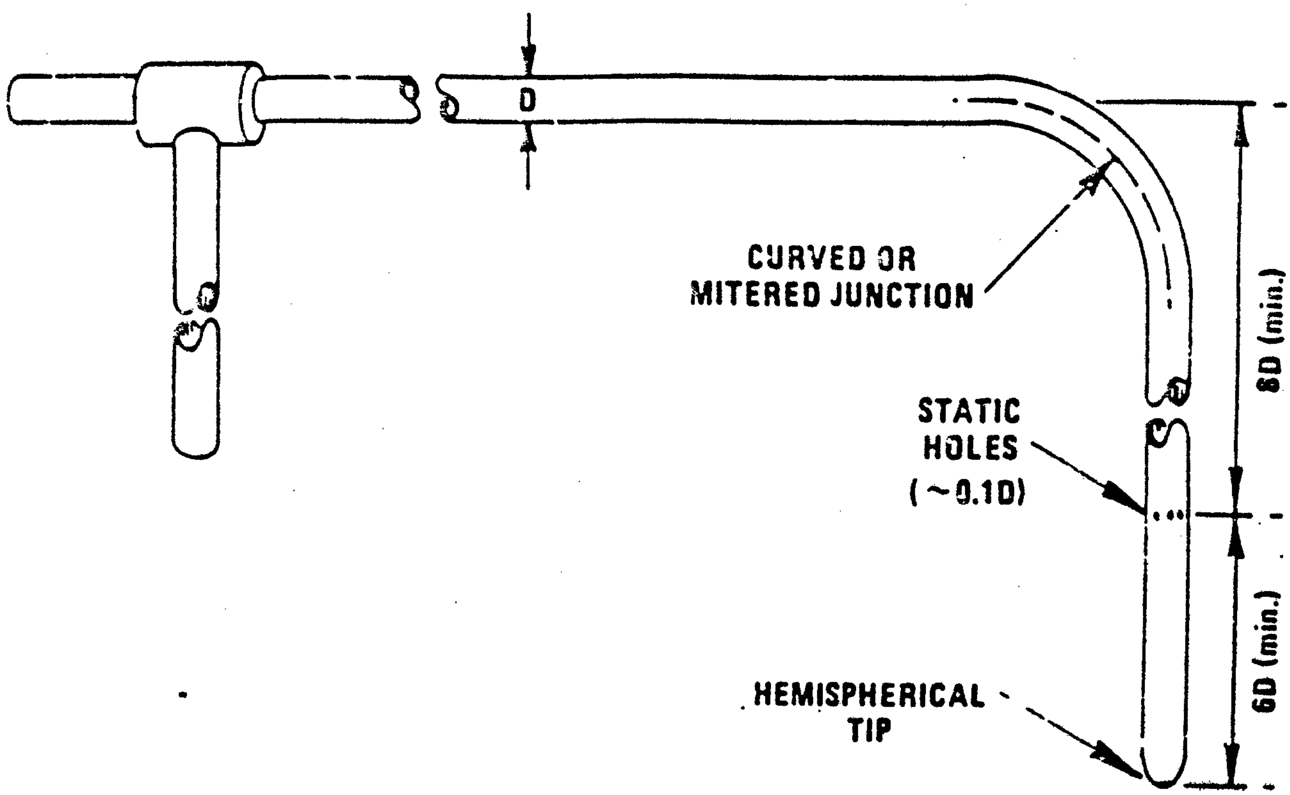


Figure 2-4. Standard pitot tube design specifications.

3. *Procedure*

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak-check procedures, subject to the approval of the Administrator may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-3).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

PLANT ______________________ ____________
DATE ______________ RUN NO. ____________
STACK DIAMETER OR DIMENSIONS, m(in.) ____________
BAROMETRIC PRESSURE, mm Hg (in. Hg) ____________
CROSS SECTIONAL AREA, $m^2(ft^2)$ ____________
OPERATORS ____________
PITOT TUBE I.D. NO. ____________
AVG. COEFFICIENT, C_p = ____________
LAST DATE CALIBRATED ____________

SCHEMATIC OF STACK CROSS SECTION

Traverse Pt. No.	Vel. Hd., Δp mm (in.) H_2O	Stack Temperature		P_g mm Hg (in. Hg)	$\sqrt{\Delta p}$
		t_s, °C (°F)	T_s, °K (°R)		
		Average			

Figure 2-5. Velocity traverse data.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. *Calibration*

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.) and if P_A and P_B are equal and between 1.0 1.50 D_t, there are two possible option the pitot tube may be calibrated acco to the procedure outlined in Sections through 4.1.5 below, or (2) a baseline (i ed tube) coefficient value of 0.84 may signed to the pitot tube. Note, however if the pitot tube is part of an assembly bration may still be required, despite k edge of the baseline coefficient value Section 4.1.1).

If D_t, P_A, and P_B are outside the spe limits, the pitot tube must be calibrat outlined in 4.1.2 through 4.1.5 below.

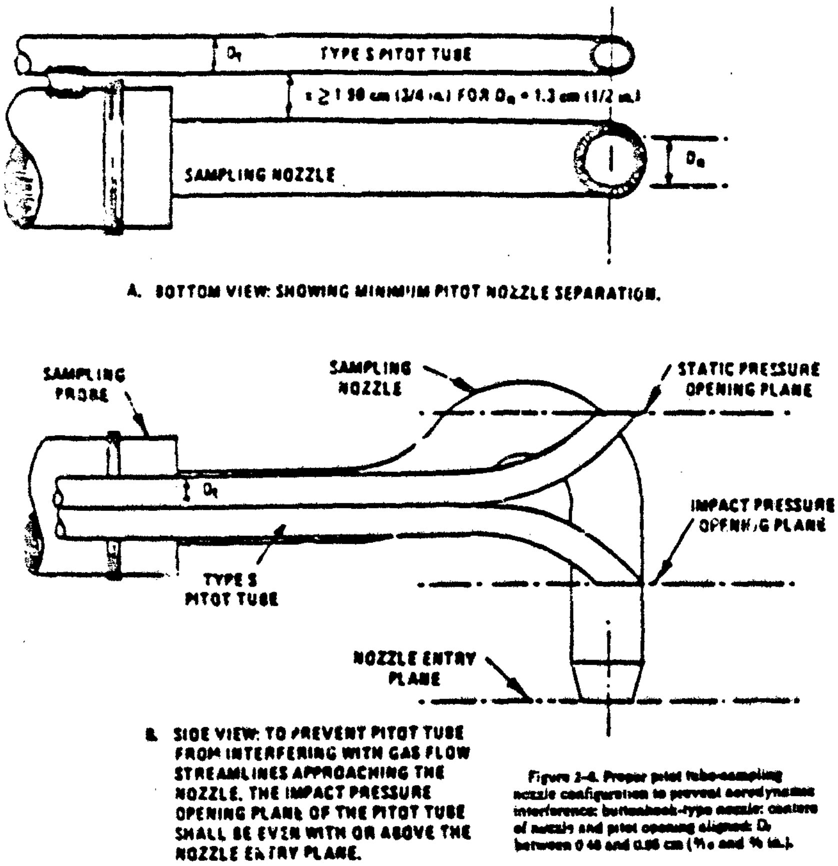


Figure 2-6. Proper pitot tube-sampling nozzle configuration to prevent aerodynamic interference; buttonhook-type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:

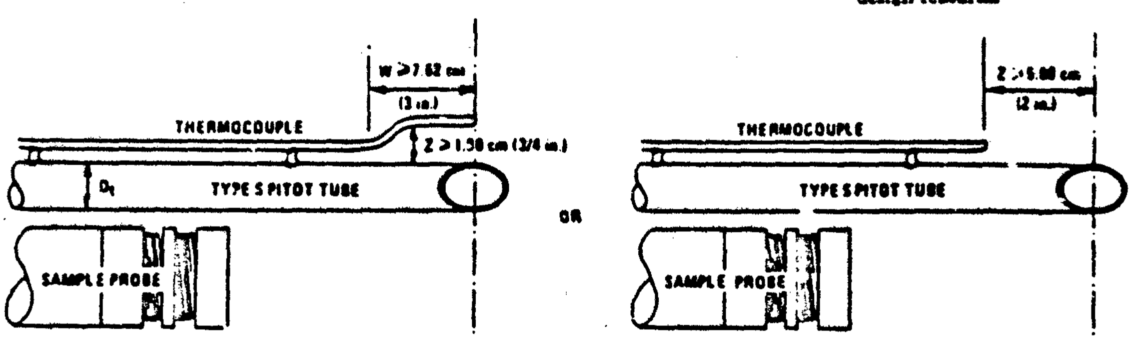


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

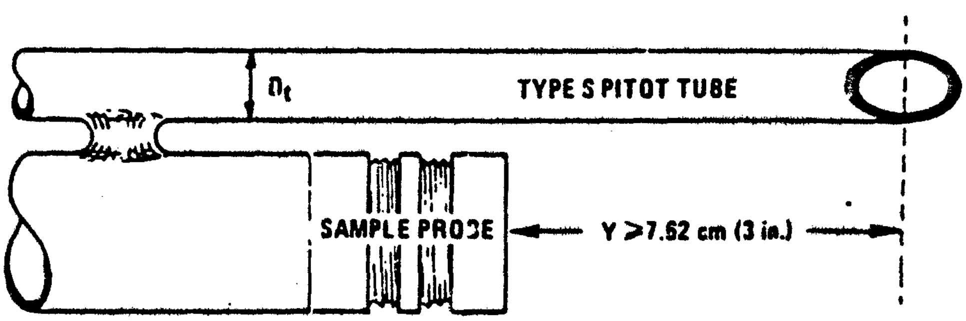


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D = \frac{2LW}{(L+W)}$$

Equation 2-1

where:
D_e = Equivalent diameter
L = Length
W = Width

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ±3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ±5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

PITOT TUBE IDENTIFICATION NUMBER: ______________ DATE: ______________

CALIBRATED BY: ______________________________

"A" SIDE CALIBRATION

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1				
2				
3				
		$\bar{C}_p$ (SIDE A)		

"B" SIDE CALIBRATION

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \le 0.01$$

$$\left| \bar{C}_p\,(\text{SIDE A}) - \bar{C}_p\,(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \le 0.01$$

Figure 2-9. Pitot tube calibration data.

4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read Δp_{std} and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read Δp_s and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer.

4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of Δp readings have been obtained.

4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of Δp readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$

Equation 2-2

where:

$C_{p(s)}$ = Type S pitot tube coefficient

$C_{p(std)}$ = Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

Δp_{std} = Velocity head measured by the standard pitot tube, cm H_2O (in. H_2O)

Δp_s = Velocity head measured by the Type S pitot tube, cm H_2O (in H_2O)

4.1.4.2 Calculate $\bar{C}_p$ (side A), the mean A-side coefficient, and $\bar{C}_p$ (side B), the mean B-side coefficient; calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of $C_{p(s)}$ from $\bar{C}_p$ (side A), and the deviation of each B-side value of $C_{p(s)}$ from $\bar{C}_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p(s)} - \bar{C}_p(\text{A or B})$$

Equation 2-3

4.1.4.4 Calculate σ, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma\,(\text{side A or B}) = \frac{\sum_{1}^{3} |C_{p(s)} - \bar{C}_p(A \text{ or } B)|}{3}$$

Equation 2-4

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between $\bar{C}_p$ (A) and $\bar{C}_p$ (B) is 0.01 or less.

4.1.5 Special considerations.

4.1.5.1 Selection of calibration point.

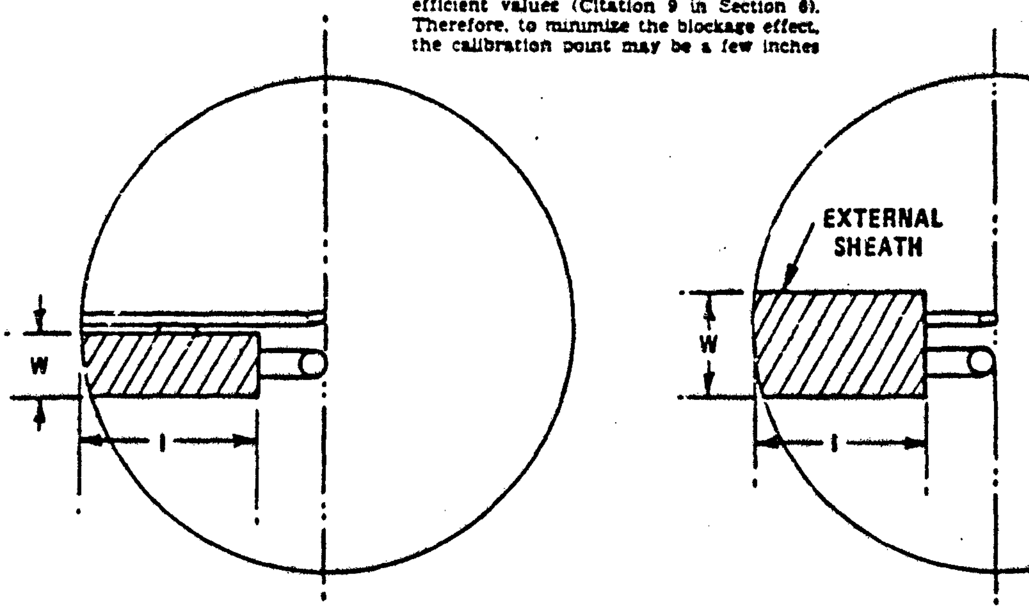
4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., $\bar{C}_p$ (side A) and $\bar{C}_p$ (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6, and 2-8).

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_{p(s)}$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or ¼ in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).



(a) (b)

$$\text{ESTIMATED SHEATH BLOCKAGE (\%)} = \left[\frac{l \times W}{\text{DUCT AREA}}\right] \times 100$$

Figure 2-10. Projected-area models for typical pitot tube assemblies.

'igure 2-10. Projected-area models for typi- al pitot tube assemblies.

4.1.6 Field Use and Recalibration.

4.1.6.1 Field Use.

4.1.6.1.1 When a Type S pitot tube (iso- ated tube or assembly) is used in the field, he appropriate coefficient value (whether ssigned or obtained by calibration) shall be sed to perform velocity calculations. For alibrated Type S pitot tubes, the A side co- fficient shall be used when the A side of he tube faces the flow, and the B side coef- icient shall be used when the B side faces he flow; alternatively, the arithmetic aver- ge of the A and B side coefficient values lay be used, irrespective of which side faces he flow.

4.1.6.1.2 When a probe assembly is used o sample a small duct (12 to 36 in. in diame- er), the probe sheath sometimes blocks a ignificant part of the duct cross-section, ausing a reduction in the effective value of $C_{p(s)}$. Consult Citation 9 in Section 6 for de- ails. Conventional pitot-sampling probe as- emblies are not recommended for use in ucts having inside diameters smaller than 2 inches (Citation 16 in Section 6).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each eld use, the pitot tube shall be carefully eexamined in top, side, and end views. If he pitot face openings are still aligned ithin the specifications illustrated in igure 2-2 or 2-3, it can be assumed that the aseline coefficient of the pitot tube has not hanged. If, however, the tube has been amanged to the extent that it no longer eets the specifications of Figure 2-2 or 2- , the damage shall either be repaired to re- ore proper alignment of the face openings r the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After ach field use, check the face opening align- ent of the pitot tube, as in Section 1.6.2.1; also, remeasure the intercompon- nt spacings of the assembly. If the inter- omponent spacings have not changed and ne face opening alignment is acceptable, it an be assumed that the coefficient of the ssembly has not changed. If the face open- ng alignment is no longer within the speci- cations of Figures 2-2 or 2-3, either repair ne damage or replace the pitot tube (cali- rating the new assembly, if necessary). If ne intercomponent spacings have changed, estore the original spacings or recalibrate ne assembly.

4.2 Standard pitot tube (if applicable). If standard pitot tube is used for the velocity averse, the tube shall be constructed ac- ording to the criteria of Section 2.7 and nall be assigned a baseline coefficient value f 0.99. If the standard pitot tube is used as art of an assembly, the tube shall be in an nterference-free arrangement (subject to ne approval of the Administrator).

4.3 Temperature Gauges. After each eld use, calibrate dial thermometers, quid-filled bulb thermometers, thermocou- le-potentiometer systems, and other auges at a temperature within 10 percent f the average absolute stack temperature. or temperatures up to 405° C (761° F), use n ASTM mercury-in-glass reference ther- ometer, or equivalent, as a reference; al- ernatively, either a reference thermocouple nd potentiometer (calibrated by NBS) or nermometric fixed points, e.g., ice bath and oiling water (corrected for barometric pres- ure) may be used. For temperatures above 05° C (761° F), use an NBS-calibrated refer- nce thermocouple-potentiometer system or n alternate reference, subject to the ap- roval of the Administrator.

If, during calibration, the absolute tem- peratures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Admin- istrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

A = Cross-sectional area of stack, m² (ft²).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), pro- portion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant.

$$34.97 \frac{m}{sec}\left[\frac{(g/g\text{-mole})(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$$

for the metric system and

$$85.49 \frac{ft}{sec}\left[\frac{(lb/lb\text{-mole})(in.\ Hg)}{(°R)(in.\ H_2O)}\right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$= M_d (1 - B_{ws}) + 18.0\ B_{ws}$

Equation 2-5

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack static pressure, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

$= P_{bar} + P_g$

Equation 2-6

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd} = Dry volumetric stack gas flow rate cor- rected to standard conditions, dscm/hr (dscf/hr).

t_s = Stack temperature, °C (°F).

T_s = Absolute stack temperature, °K, (°R).

$= 273 + t_s$ for metric

Equation 2-7

$= 460 + t_s$ for English

Equation 2-8

T_{std} = Standard absolute temperature, 293 °K (528° R)

v_s = Average stack gas velocity, m/sec (ft/ sec).

Δp = Velocity head of stack gas, mm H₂O (in. H₂O).

3,600 = Conversion factor, sec/hr.

18.0 = Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average stack gas velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

Equation 2-9

5.3 Average stack gas dry volumetric flow rate.

$$Q_{sd} = 3{,}600(1 - B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

Equation 2-10

"To convert Q_{sd} from dscm/hr (dscf/hr) to dscm/min (dscf/ min), divide Q_{sd} by 60."

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EPA METHOD 25A

DETERMINATION OF TOTAL GASEOUS ORGANIC CONCENTRATION USING A FLAME IONIZATION ANALYZER

METHOD 25A—DETERMINATION OF TOTAL GASEOUS ORGANIC CONCENTRATION USING A FLAME IONIZATION ANALYZER

1. *Applicability and Principle.*

1.1 Applicability. This method applies to the measurement of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

1.2 Principle. A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

2. *Definitions.*

2.1 Measurement System. The total equipment required for the determination of the gas concentration. The system consists of the following major subsystems:

2.1.1 Sample Interface. That portion of the system that is used for one or more of the following: sample acquisition, sample transportation, sample conditioning, or protection of the analyzer from the effects of the stack effluent.

2.1.2 Organic Analyzer. That portion of the system that senses organic concentration and generates an output proportional to the gas concentration.

2.2 Span Value. The upper limit of a gas concentration measurement range that is specified for affected source categories in the applicable part of the regulations. The span value is established in the applicable regulation and is usually 1.5 to 2.5 times the applicable emission limit. If no span value is provided, use a span value equivalent to 1.5 to 2.5 times the expected concentration. For convenience, the span value should correspond to 100 percent of the recorder scale.

2.3 Calibration Gas. A known concentration of a gas in an appropriate diluent gas.

2.4 Zero Drift. The difference in the measurement system response to a zero level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

2.5 Calibration Drift. The difference in the measurement system response to a mid-level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair or adjustment took place.

2.6 Response Time. The time interval from a step change in pollutant concentration at the inlet to the emission measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the recorder.

2.7 Calibration Error. The difference between the gas concentration indicated by the measurement system and the known concentration of the calibration gas.

3. *Apparatus.*

A schematic of an acceptable measurement system is shown in Figure 25A-1. The essential components of the measurement system are described below:

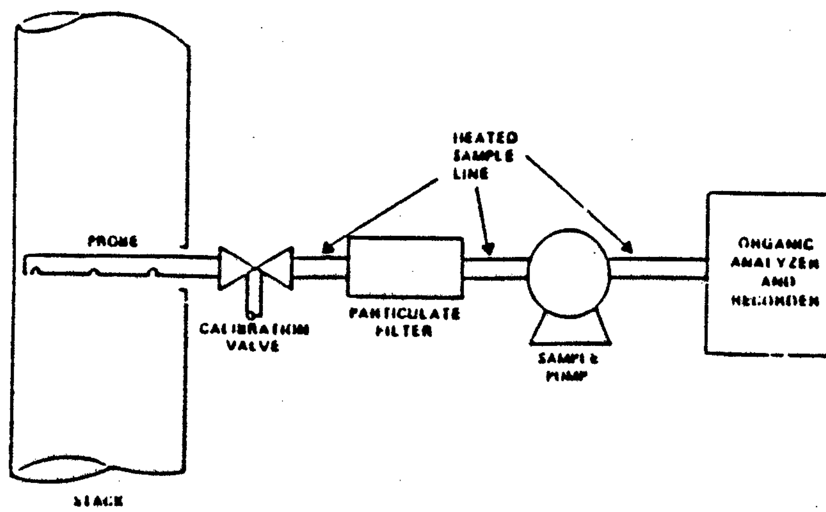

Figure 25A-1. Organic Concentration Measurement System.

3.1 Organic Concentration Analyzer. A flame ionization analyzer (FIA) capable of meeting or exceeding the specifications in this method.

3.2 Sample Probe. Stainless steel, or equivalent, three-hole rake type. Sample holes shall be 4 mm in diameter or smaller and located at 16.7, 50, and 83.3 percent of the equivalent stack diameter. Alternatively, a single opening probe may be used so that a gas sample is collected from the centrally located 10 percent area of the stack cross-section.

3.3 Sample Line. Stainless steel or Teflon* tubing to transport the sample gas to the analyzers. The sample line should be heated, if necessary, to prevent condensation in the line.

3.4 Calibration Valve Assembly. A three-way valve assembly to direct the zero and calibration gases to the analyzers is recommended. Other methods, such as quick-connect lines, to route calibration gas to the analyzers are applicable.

3.5 Particulate Filter. An in-stack or an out-of-stack glass fiber filter is recommended if exhaust gas particulate loading is significant. An out-of-stack filter should be heated to prevent any condensation.

3.6 Recorder. A strip-chart recorder, analog computer, or digital recorder for recording measurement data. The minimum data recording requirement is one measurement value per minute. Note: This method is often applied in highly explosive areas. Caution and care should be exercised in choice of equipment and installation.

4. *Calibration and Other Gases.*

Gases used for calibrations, fuel, and combustion air (if required) are contained in compressed gas cylinders. Preparation of calibration gases shall be done according to the procedure in Protocol No. 1, listed in Reference 9.2. Additionally, the manufacturer of the cylinder should provide a recommended shelf life for each calibration gas cylinder over which the concentration does not change more than ±2 percent from the certified value. For calibration gas values not generally available (i.e., organics between 1 and 10 percent by volume), alternative methods for preparing calibration gas mixtures, such as dilution systems, may be used with prior approval of the Administrator.

Calibration gases usually consist of propane in air or nitrogen and are determined in terms of the span value. Organic compounds other than propane can be used following the above guidelines and making the appropriate corrections for response factor.

4.1 Fuel. A 40 percent H_2/60 percent He or 40 percent H_2/60 percent N_2 gas mixture is recommended to avoid an oxygen synergism effect that reportedly occurs when oxygen concentration varies significantly from a mean value.

4.2 Zero Gas. High purity air with less than 0.1 parts per million by volume (ppmv) of organic material (propane or carbon equivalent) or less than 0.1 percent of the span value, whichever is greater.

4.3 Low-level Calibration Gas. An organic calibration gas with a concentration equivalent to 25 to 35 percent of the applicable span value.

4.4 Mid-level Calibration Gas. An organic calibration gas with a concentration equivalent to 45 to 55 percent of the applicable span value.

4.5 High-level Calibration Gas. An organic calibration gas with a concentration equivalent to 80 to 90 percent of the applicable span value.

5. *Measurement System Performance Specifications.*

5.1 Zero Drift. Less than ±3 percent of the span value.

5.2 Calibration Drift. Less than ±3 percent of span value.

5.3 *Calibration Error.* Less than ±5 percent of the calibration gas value.

6. *Pretest Preparations.*

6.1 *Selection of Sampling Site.* The location of the sampling site is generally specified by the applicable regulation or purpose of the test; i.e., exhaust stack, inlet line, etc. The sample port shall be located at least 1.5 meters or 2 equivalent diameters (whichever is less) upstream of the gas discharge to the atmosphere.

6.2 *Location of Sample Probe.* Install the sample probe so that the probe is centrally located in the stack, pipe, or duct and is sealed tightly at the stack port connection.

6.3 *Measurement System Preparation.* Prior to the emission test, assemble the measurement system following the manufacturer's written instructions in preparing the sample interface and the organic analyzer. Make the system operable.

FIA equipment can be calibrated for almost any range of total organics concentrations. For high concentrations of organics (>1.0 percent by volume as propane) modifications to most commonly available analyzers are necessary. One accepted method of equipment modification is to decrease the size of the sample to the analyzer through the use of a smaller diameter sample capillary. Direct and continuous measurement of organic concentration is a necessary consideration when determining any modification design.

6.4 *Calibration Error Test.* Immediately prior to the test series, (within 2 hours of the start of the test) introduce zero gas and high-level calibration gas at the calibration valve assembly. Adjust the analyzer output to the appropriate levels, if necessary. Calculate the predicted response for the low-level and mid-level gases based on a linear response line between the zero and high-level responses. Then introduce low-level and mid-level calibration gases successively to the measurement system. Record the analyzer responses for low-level and mid-level calibration gases and determine the differences between the measurement system responses and the predicted responses. These differences must be less than 5 percent of the respective calibration gas value. If not, the measurement system is not acceptable and must be replaced or repaired prior to testing. No adjustments to the measurement system shall be conducted after the calibration and before the drift check (Section 7.3). If adjustments are necessary before the completion of the test series, perform the drift checks prior to the required adjustments and repeat the calibration following the adjustments. If multiple electronic ranges are to be used, each additional range must be checked with a mid-level calibration gas to verify the multiplication factor.

6.5 *Response Time Test.* Introduce zero gas into the measurement system at the calibration valve assembly. When the system output has stabilized, switch quickly to the high-level calibration gas. Record the time from the concentration change to the measurement system response equivalent to 95 percent of the step change. Repeat the test three times and average the results.

7. *Emission Measurement Test*

7.1 *Organic Measurement.* Begin sampling at the start of the test period, recording time and any required process information as appropriate. In particular, note on the recording chart periods of process interruption or cyclic operation.

7.2 *Drift Determination.* Immediately following the completion of the test period and hourly during the test period, reintroduce the zero and mid-level calibration gases, one at a time, to the measurement system at the calibration valve assembly. (Make no adjustments to the measurement system until after both the zero and calibration drift checks are made.) Record the analyzer response. If the drift values exceed the specified limits, invalidate the test results preceding the check and repeat the test following corrections to the measurement system. Alternatively, recalibrate the test measurement system as in Section 6.4 and report the results using both sets of calibration data (i.e., data determined prior to the test period and data determined following the test period).

8. *Organic Concentration Calculations.*

Determine the average organic concentration in terms of ppmv as propane or other calibration gas. The average shall be determined by the integration of the output recording over the period specified in the applicable regulation.

If results are required in terms of ppmv as carbon, adjust measured concentrations using Equation 25A-1.

$$C_c = K\, C_{meas}$$

Eq. 25A-1

Where:

C_c = Organic concentration as carbon, ppmv.

C_{meas} = Organic concentration as measured, ppmv.

K = Carbon equivalent correction factor,

K = 2 for ethane.

K = 3 for propane.

K = 4 for butane.

K = Appropriate response factor for other organic calibration gases.

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EPA METHOD 3

GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

METHOD 3—GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted from a stack, by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent carbon dioxide (CO_2), percent oxygen (O_2), and, if necessary, percent carbon monoxide (CO). If a dry molecular weight determination is to be made, either an Orsat or a Fyrite[1] analyzer may be used for the analysis; for excess air or emission rate correction factor determination, an Orsat analyzer must be used.

1.2 Applicability. This method is applicable for determining CO_2 and O_2 concentrations, excess air, and dry molecular weight of a sample from a gas stream of a fossil-fuel combustion process. The method may also be applicable to other processes where it has been determined that compounds other than CO_2, O_2, CO, and nitrogen (N_2) are not present in concentrations sufficient to affect the results.

Other methods, as well as modifications to the procedure described herein, are also applicable for some or all of the above determinations. Examples of specific methods and modifications include: (1) a multi-point sampling method using an Orsat analyzer to analyze individual grab samples obtained at each point; (2) a method using CO_2 or O_2 and stoichiometric calculations to determine dry molecular weight and excess air; (3) assigning a value of 30.0 for dry molecular weight, in lieu of actual measurements, for processes burning natural gas, coal, or oil. These methods and modifications may be used, but are subject to the approval of the Administrator, U.S. Environmental Protection Agency.

2. *Apparatus*

As an alternative to the sampling apparatus and systems described herein, other sampling systems (e.g., liquid displacement) may be used provided such systems are capable of obtaining a representative sample and maintaining a constant sampling rate, and are otherwise capable of yielding acceptable results. Use of such systems is subject to the approval of the Administrator.

2.1 Grab Sampling (Figure 3-1).

2.1.1 Probe. The probe should be made of stainless steel or borosilicate glass tubing and should be equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Any other materials inert to O_2, CO_2, CO, and N_2 and resistant to temperature at sampling conditions may be used for the probe; examples of such material are aluminum, copper, quartz glass and Teflon.

2.1.2 Pump. A one-way squeeze bulb, or equivalent, is used to transport the gas sample to the analyzer.

2.2 Integrated Sampling (Figure 3-2).

2.2.1 Probe. A probe such as that described in Section 2.1.1 is suitable.

2.2.2 Condenser. An air-cooled or water-cooled condenser, or other condenser that will not remove O_2, CO_2, CO, and N_2, may be used to remove excess moisture which would interfere with the operation of the pump and flow meter.

2.2.3 Valve. A needle valve is used to adjust sample gas flow rate.

2.2.4 Pump. A leak-free, diaphragm-type pump, or equivalent, is used to transport sample gas to the flexible bag. Install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.2.5 Rate Meter. The rotameter, or equivalent rate meter, used should be capable of measuring flow rate to within ±2 percent of the selected flow rate. A flow rate range of 500 to 1000 cm^3/min is suggested.

2.2.6 Flexible Bag. Any leak-free plastic (e.g., Tedlar, Mylar, Teflon) or plastic-coated aluminum (e.g., aluminized Mylar) bag, or equivalent, having a capacity consistent with the selected flow rate and time length of the test run, may be used. A capacity in the range of 55 to 90 liters is suggested.

To leak-check the bag, connect it to a water manometer and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O). Allow to stand for 10 minutes. Any displacement in the water manometer indicates a leak. An alternative leak-check method is to pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O) and allow to stand overnight. A deflated bag indicates a leak.

2.2.7 Pressure Gauge. A water-filled U-tube manometer, or equivalent, of about 30 cm (12 in.) is used for the flexible bag leak-check.

2.2.8 Vacuum Gauge. A mercury manometer, or equivalent, of at least 760 mm Hg (30 in. Hg) is used for the sampling train leak-check.

2.3 Analysis. For Orsat and Fyrite analyzer maintenance and operation procedures, follow the instructions recommended by the manufacturer, unless otherwise specified herein.

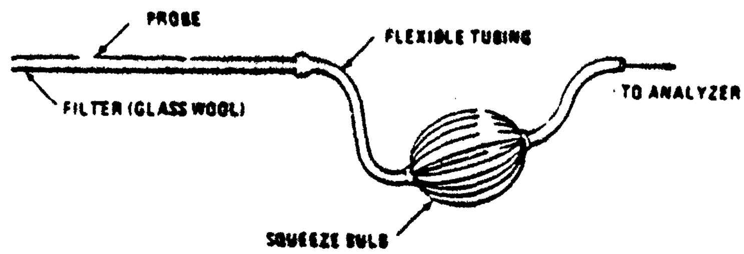

Figure 3-1. Grab sampling train.

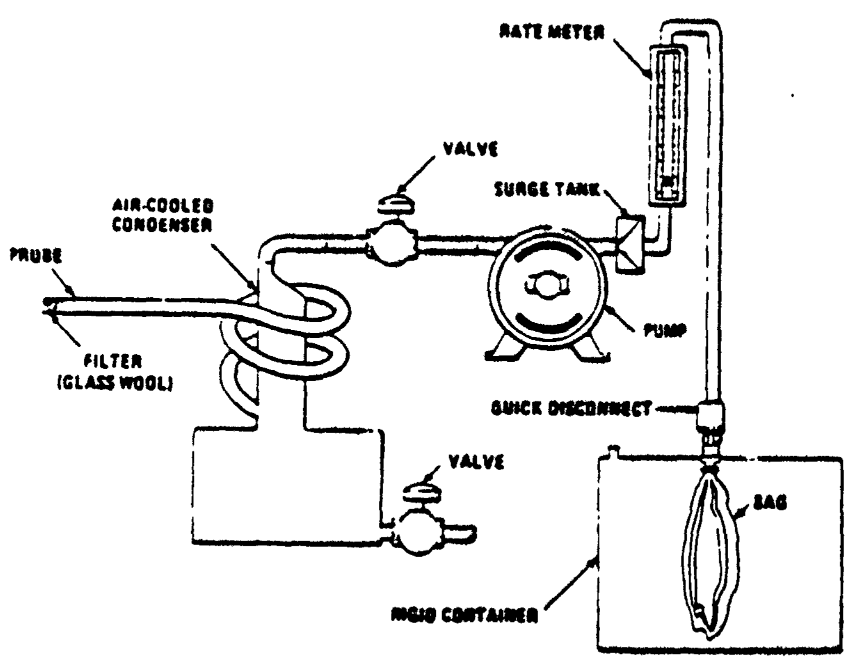

Figure 3-2. Integrated gas-sampling train.

[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.3.1 Dry Molecular Weight Determination. An Orsat analyzer or Pyrite type combustion gas analyzer may be used.

2.3.2 Emission Rate Correction Factor or Excess Air Determination. An Orsat analyzer must be used. For low CO_2 (less than 4.0 percent) or high O_2 (greater that 15.0 percent) concentrations, the measuring burette of the Orsat must have at least 0.1 percent subdivisions.

3. *Dry Molecular Weight Determination*

Any of the three sampling and analytical procedures described below may be used for determining the dry molecular weight.

3.1 Single-Point, Grab Sampling and Analytical Procedure.

3.1.1 The sampling point in the duct shall either be at the centroid of the cross section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

3.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. If and Orsat analyzer is used, it is recommended that the analyzer be leaked-checked by following the procedure in Section 5; however, the leak-check is optional.

3.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer and immediately analyze it for percent CO_2 and percent O_2. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.1.4 Repeat the sampling, analysis, and calculation procedures, until the dry molecular weights of any three grab samples differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (lb/lb-mole).

3.2 Single-Point, Integrated Sampling and Analytical Procedure.

3.2.1 The sampling point in the duct shall be located as specified in Section 3.1.1.

3.2.2 Leak-check (optional) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (optional) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum should remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

3.2.3 Sample at a constant rate. The sampling run should be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collection of at least 30 liters (1.00 ft³) of sample gas is recommended; however, smaller volumes may be collected, if desired.

3.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. Within 8 hours after the sample is taken, analyze it for percent CO_2 and percent O_2 using either an Orsat analyzer or a Pyrite-type combustion gas analyzer. If an Orsat analyzer is used, it is recommended that the Orsat leak-check described in Section 5 be performed before this determination; however, the check is optional. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 5.3.

3.2.5 Repeat the analysis and calculation procedures until the individual dry molecular weights for any three analyses differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

3.3 Multi-Point, Integrated Sampling and Analytical Procedure.

3.3.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used for all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to approval of the Administrator.

3.3.2 Follow the procedures outlined in sections 3.2.2 throught 3.2.5, except for the following: traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4. *Emission Rate Correction Factor or Excess Air Determination*

NOTE: A Pyrite-type combustion gas analyzer is not acceptable for excess air or emission rate correction factor determination, unless approved by the Administrator. If both percent CO_2 and percent O_2 are measured, the analytical results of any of the three procedures given below may also be used for calculating the dry molecular weight.

Each of the three procedures below shall be used only when specified in an applicable subpart of the standards. The use of these procedures for other purposes must have specific prior approval of the Administrator.

4.1 Single-Point, Grab Sampling and Analytical Procedure.

4.1.1 The sampling point in the duct shall either be at the centroid of the cross-section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

4.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. Leak-check the Orsat analyzer according to the procedure described in Section 5. This leak-check is mandatory.

FIGURE 3-3—SAMPLING RATE DATA

Time	Traverse pt.	Q lpm	% dev.*
Average			

*% Dev.=(Q−Q_avg)/Q_avg × 100 (Must be <(10%))

4.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer. For emission rate correction factor determination, immediately analyze the sample, as outlined in Sections 4.1.4 and 4.1.5, for percent CO_2 or percent O_2. If excess air is desired, proceed as follows: (1) immediately analyze the sample, as in Sections 4.1.4 and 4.1.5, for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; and (3) calculate percent excess air as outlined in Section 6.2.

4.1.4 To insure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.1.5 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis.

NOTE: Since this single-point, grab sampling and analytical procedure in normally conducted in conjunction with a single-point, grab sampling and analytical procedure for a pollutant, only one analysis is ordinarily conducted. Therefore, great care must be taken to obtain a valid sample and analysis. Although in most cases only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Section 4.4 be used to validate the analytical data.

4.2 Single-Point, Integrated Sampling and Analytical Procedure.

4.2.1 The sampling point in the duct shall be located as specified in Section 4.1.1.

4.2.2 Leak-check (mandatory) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (mandatory) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of a least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum shall remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

4.2.3 Sample at a constant rate, or as specified by the Administrator. The sampling run must be simultaneous with and for the same total length of time as, the pollutant emission rate determination. Collect at least 30 Liters (1.00 ft³) of sample gas. Smaller volumes may be collected, subject to approval of the Administrator.

4.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. For emission rate correction factor determination, analyze the sample within 4 hours after it is taken for percent CO_2 or percent O_2 (as outlined in Sections 4.2.5 through 4.2.7). The Orsat analyzer must be leak-check (see Section 5) before the analysis. If excess air is desired, proceed as follows: (1) within 4 hours after the sample is taken, analyze it (as in Sections 4.2.5 through 4.2.7) for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; (3) calculate percent excess air, as outlined in Section 6.2.

EPA METHOD 10

DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

Method 10—Determination of Carbon Monoxide Emissions From Stationary Sources

1. *Principle and Applicability.*

1.1 *Principle.* An integrated or continuous gas sample is extracted from a sampling point and analyzed for carbon monoxide (CO) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent.

1.2 *Applicability.* This method is applicable for the determination of carbon monoxide emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or an integrated sample is to be used.

2. *Range and sensitivity.*

2.1 *Range.* 0 to 1,000 ppm.

2.2 *Sensitivity.* Minimum detectable concentration is 20 ppm for a 0 to 1,000 ppm span.

3. *Interferences.* Any substance having a strong absorption of infrared energy will interfere to some extent. For example, discrimination ratios for water (H_2O) and carbon dioxide (CO_2) are 3.5 percent H_2O per 7 ppm CO and 10 percent CO_2 per 10 ppm CO, respectively, for devices measuring in the 1,500 to 3,000 ppm range. For devices measuring in the 0 to 100 ppm range, interference ratios can be as high as 3.5 percent H_2O per 25 ppm CO and 10 percent CO_2 per 50 ppm CO. The use of silica gel and ascarite traps will alleviate the major interference problems. The measured gas volume must be corrected if these traps are used.

4. *Precision and accuracy.*

4.1 *Precision.* The precision of most NDIR analyzers is approximately ±2 percent of span.

4.2 *Accuracy.* The accuracy of most NDIR analyzers is approximately ±5 percent of span after calibration.

5. *Apparatus.*

5.1 *Continuous sample* (Figure 10-1).

5.1.1 *Probe.* Stainless steel or sheathed Pyrex[1] glass, equipped with a filter to remove particulate matter.

5.1.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2 *Integrated sample* (Figure 10-2).

5.2.1 *Probe.* Stainless steel or sheathed Pyrex glass, equipped with a filter to remove particulate matter.

5.2.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2.3 *Valve.* Needle valve, or equivalent, to to adjust flow rate.

5.2.4 *Pump.* Leak-free diaphragm type, or equivalent, to transport gas.

5.2.5 *Rate meter.* Rotameter, or equivalent, to measure a flow range from 0 to 1.0 liter per min. (0.035 cfm).

5.2.6 *Flexible bag.* Tedlar, or equivalent, with a capacity of 60 to 90 liters (2 to 3 ft³). Leak-test the bag in the laboratory before using by evacuating bag with a pump fol-

[1]Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

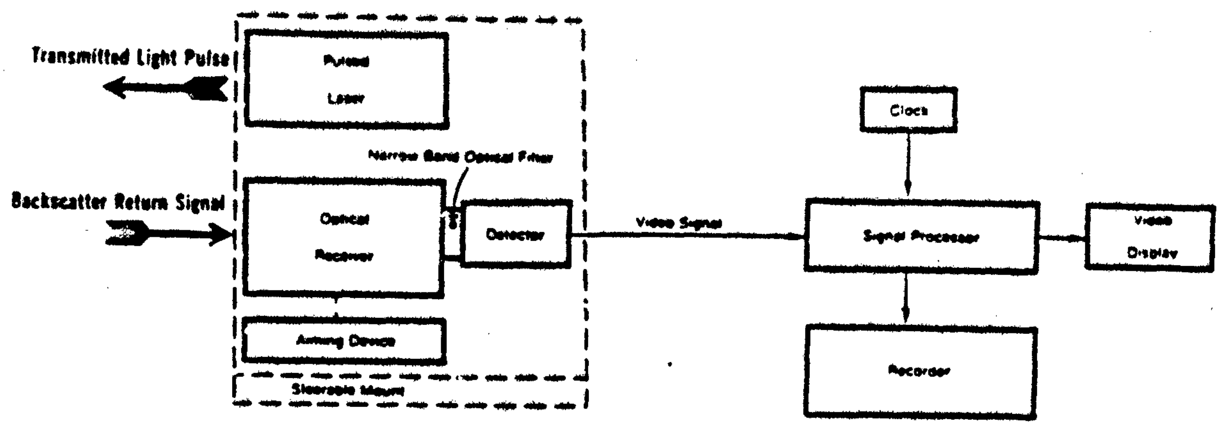

Figure AM1-VII. Functional Block Diagram of a Basic Lidar System

owed by a dry gas meter. When evacuation is complete, there should be no flow through the meter.

5.2.7 *Pitot tube.* Type S, or equivalent, attached to the probe so that the sampling rate can be regulated proportional to the stack gas velocity when velocity is varying with the time or a sample traverse is conducted.

5.3 *Analysis* (Figure 10-3).

5.3.1 *Carbon monoxide analyzer.* Nondispersive infrared spectrometer, or equivalent. This instrument should be demonstrated, preferably by the manufacturer, to meet or exceed manufacturer's specifications and those described in this method.

5.3.2 *Drying tube.* To contain approximately 200 g of silica gel.

5.3.3 *Calibration gas.* Refer to paragraph 6.1.

5.3.4 *Filter.* As recommended by NDIR manufacturer.

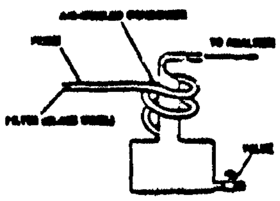

Figure 10-1. Continuous sampling train.

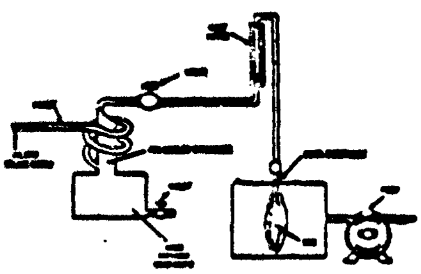

Figure 10-2. Integrated gas-sampling train.

5.3.5 CO_2 removal tube. To contain approximately 500 g of ascarite.

5.3.6 *Ice water bath.* For ascarite and silica gel tubes.

5.3.7 *Valve.* Needle valve, or equivalent, to adjust flow rate.

5.3.8 *Rate meter.* Rotameter or equivalent to measure gas flow rate of 0 to 1.0 liter per min. (0.035 cfm) through NDIR.

5.3.9 *Recorder* (optional). To provide permanent record of NDIR readings.

6. *Reagents.*

6.1 *Calibration gases.* Known concentration of CO in nitrogen (N_2) for instrument span, prepurified grade of N_2 for zero, and two additional concentrations corresponding approximately to 60 percent and 30 percent span. The span concentration shall not exceed 1.5 times the applicable source performance standard. The calibration gases shall be certified by the manufacturer to be within ±2 percent of the specified concentration.

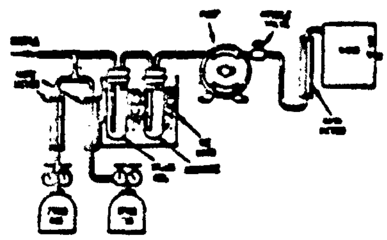

Figure 10-3. Analytical equipment.

6.2 *Silica gel.* Indicating type, 6 to 16 mesh, dried at 175° C (347° F) for 2 hours.

6.3 *Ascarite.* Commercially available.

7. *Procedure.*

7.1 *Sampling.*

7.1.1 *Continuous sampling.* Set up the equipment as shown in Figure 10-1 making sure all connections are leak free. Place the probe in the stack at a sampling point and purge the sampling line. Connect the analyzer and begin drawing sample into the analyzer. Allow 5 minutes for the system to stabilize, then record the analyzer reading as required by the test procedure. (See ¶ 7.2 and 8). CO_2 content of the gas may be determined by using the Method 3 integrated sample procedure (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.1.2 *Integrated sampling.* Evacuate the flexible bag. Set up the equipment as shown in Figure 10-2 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are leak free. Sample at a rate proportional to the stack velocity. CO_2 content of the gas may be determined by using the Method 3 integrated sample procedures (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.2 *CO Analysis.* Assemble the apparatus as shown in Figure 10-3, calibrate the instrument, and perform other required operations as described in paragraph 8. Purge analyzer with N_2 prior to introduction of each sample. Direct the sample stream through the instrument for the test period, recording the readings. Check the zero and span again after the test to assure that any drift or malfunction is detected. Record the sample data on Table 10-1.

8. *Calibration.* Assemble the apparatus according to Figure 10-3. Generally an instrument requires a warm-up period before stability is obtained. Follow the manufacturer's instructions for specific procedure. Allow a minimum time of 1 hour for warm-up. During this time check the sample conditioning apparatus, i.e., filter, condenser, drying tube, and CO_2 removal tube, to ensure that each component is in good operating condition. Zero and calibrate the instrument according to the manufacturer's procedures using, respectively, nitrogen and the calibration gases.

TABLE 10-1—FIELD DATA

	Comments
Location ______	
Test ______	
Date ______	
Operator ______	

Clock time	Rotameter setting, liters per minute (cubic feet per minute)

9. *Calculation—Concentration of carbon monoxide.* Calculate the concentration of carbon monoxide in the stack using equation 10-1.

$$C_{CO_{stack}} = C_{CO_{NDIR}}(1 - F_{CO_2})$$

where:

$C_{CO_{stack}}$ = concentration of CO in stack, ppm by volume (dry basis).

$C_{CO_{NDIR}}$ = concentration of CO measured by NDIR analyzer, ppm by volume (dry basis).

F_{CO_2} = volume fraction of CO_2 in sample, i.e., percent CO_2 from Orsat analysis divided by 100.

10. *Bibliography.*

10.1 McElroy, Frank. The Intertech NDIR-CO Analyzer. Presented at 11th Methods Conference on Air Pollution, University of California, Berkeley, Calif., April 1, 1970.

10.2 Jacobs, M. B., et al. Continuous Determination of Carbon Monoxide and Hydrocarbons in Air by a Modified Infrared Analyzer, J. Air Pollution Control Association, 9(2): 110-114, August 1959.

10.3 MSA LIRA Infrared Gas and Liquid Analyzer Instruction Book, Mine Safety Appliances Co., Technical Products Division, Pittsburgh, Pa.

10.4 Models 215A, 315A, and 415A Infrared Analyzers, Beckman Instruments, Inc., Beckman Instructions 1635-B, Fullerton, Calif., October 1967.

10.5 Continuous CO Monitoring System, Model A5611, Intertech Corp., Princeton, N.J.

10.6 UNOR Infrared Gas Analyzers, Bendix Corp., Ronceverte, West Virginia.

ADDENDA—A. PERFORMANCE SPECIFICATIONS FOR NDIR CARBON MONOXIDE ANALYZERS.

Range (minimum)	0-1000 ppm.
Output (minimum)	0-10mV.
Minimum detectable sensitivity.	20 ppm.
Rise time, 90 percent (maximum).	30 seconds.
Fall time, 90 percent (maximum).	30 seconds.
Zero drift (maximum)	10% in 8 hours.
Span drift (maximum)	10% in 8 hours.
Precision (minimum)	±2% of full scale.
Noise (maximum)	±1% of full scale.
Linearity (maximum deviation)	2% of full scale.
Interference rejection ratio	CO_2—1000 to 1, H_2O—500 to 1.

B. *Definitions of Performance Specifications.*

Range—The minimum and maximum measurement limits.

Output—Electrical signal which is proportional to the measurement; intended for connection to readout or data processing devices. Usually expressed as millivolts or milliamps full scale at a given impedance.

Full scale—The maximum measuring limit for a given range.

Minimum detectable sensitivity—The smallest amount of input concentration that can be detected as the concentration approaches zero.

Accuracy—The degree of agreement between a measured value and the true value; usually expressed as ± percent of full scale.

Time to 90 percent response—The time interval from a step change in the input concentration at the instrument inlet to a reading of 90 percent of the ultimate recorded concentration.

Rise Time (90 percent)—The interval between initial response time and time to 90 percent response after a step increase in the inlet concentration.

Fall Time (90 percent)—The interval between initial response time and time to 90 percent response after a step decrease in the inlet concentration.

Zero Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is zero; usually expressed as percent full scale.

Span Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is a stated upscale value; usually expressed as percent full scale.

Precision—The degree of agreement between repeated measurements of the same concentration, expressed as the average deviation of the single results from the mean.

Noise—Spontaneous deviations from a mean output not caused by input concentration changes.

Linearity—The maximum deviation between an actual instrument reading and the reading predicted by a straight line drawn between upper and lower calibration points.

EPA METHOD 4

DETERMINATION OF MOISTURE CONTENT IN STACK GASES

METHOD 4—DETERMINATION OF MOISTURE CONTENT IN STACK GASES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically.

1.2 Applicability. This method is applicable for determining the moisture content of stack gas.

Two procedures are given. The first is a reference method, for accurate determinations of moisture content (such as are needed to calculate emission data). The second is an approximation method, which provides estimates of percent moisture to aid in setting isokinetic sampling rates prior to a pollutant emission measurement run. The approximation method described herein is only a suggested approach; alternative means for approximating the moisture content, e.g., drying tubes, wet bulb-dry bulb techniques, condensation techniques, stoichiometric calculations, previous experience, etc., are also acceptable.

The reference method is often conducted simultaneously with a pollutant emission measurement run; when it is, calculation of percent isokinetic, pollutant emission rate, etc., for the run shall be based upon the results of the reference method or its equivalent; these calculations shall not be based upon the results of the approximation method, unless the approximation method is shown, to the satisfaction of the Administrator, U.S. Environmental Protection Agency, to be capable of yielding results within 1 percent H_2O of the reference method.

NOTE: The reference method may yield questionable results when applied to saturated gas streams or to streams that contain water droplets. Therefore, when these conditions exist or are suspected, a second determination of the moisture content shall be made simultaneously with the reference method, as follows: Assume that the gas stream is saturated. Attach a temperature sensor [capable of measuring to ±1° C (2° F)] to the reference method probe. Measure the stack gas temperature at each traverse point (see Section 2.2.1) during the reference method traverse; calculate the average stack gas temperature. Next, determine the moisture percentage, either by: (1) using a psychrometric chart and making appropriate corrections if stack pressure is different from that of the chart, or (2) using saturation vapor pressure tables. In cases where the pyschrometric chart or the saturation vapor pressure tables are not applicable (based on evaluation of the process), alternate methods, subject to the approval of the Administrator, shall be used.

2. *Reference Method*

The procedure described in Method 5 for determining moisture content is acceptable as a reference method.

2.1 Apparatus. A schematic of the sampling train used in this reference method is shown in Figure 4-1. All components shall be maintained and calibrated according to the procedure outlined in Method 5.

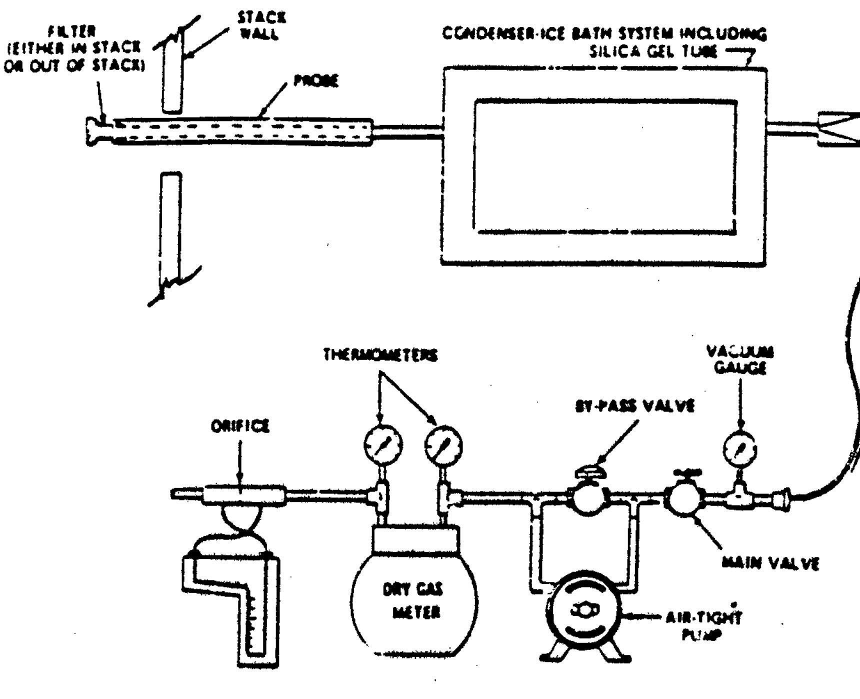

Figure 4-1. Moisture sampling train-reference method

2.1.1 Probe. The probe is constructed of stainless steel or glass tubing, sufficiently heated to prevent water condensation, and is equipped with a filter, either in-stack (e.g., a plug of glass wool inserted into the end of the probe) or heated out-stack (e.g., as described in Method 5), to remove particular matter.

When stack conditions permit, other metals or plastic tubing may be used for the probe, subject to the approval of the Administrator.

2.1.2 Condenser. The condenser consists of four impingers connected in series with ground glass, leak-free fittings or any similarly leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3 centimeter (½ inch) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator.

The first two impingers shall contain known volumes of water, the third shall be empty, and the fourth shall contain a known weight of 6- to 16-mesh indicating type silica gel, or equivalent desiccant. If the silica gel has been previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. A thermometer, capable of measuring temperature to within 1° C (2° F), shall be placed at the outlet of the fourth impinger, for monitoring purposes.

Alternatively, any system may be used (subject to the approval of the Administrator) that cools the sample gas stream and allows measurement of both the water that has been condensed and the moisture leaving the condenser, each to within 1 ml or 1 g. Acceptable means are to measure the condensed water, either gravimetrically or volumetrically, and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures, or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap, with exit gases kept below 20° C (68° F), and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump, to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

2.1.3 Cooling System. An ice bath coniner and crushed ice (or equivalent) are ;ed to aid in condensing moisture.

2.1.4 Metering System. This system inudes a vacuum gauge, leak-free pump, iermometers capable of measuring temper-.ure to within 3° C (5.4° F), dry gas meter .pable of measuring volume to within 2 ercent, and related equipment as shown in igure 4-1. Other metering systems, capable ' maintaining a constant sampling rate and :termining sample gas volume, may be ;ed, subject to the approval of the Admin-trator.

2.1.5 Barometer. Mercury, aneroid, or her barometer capable of measuring atospheric pressure to within 2.5 mm Hg .1 in. Hg) may be used. In many cases, the arometric reading may be obtained from a :arby national weather service station, in hich case the station value (which is the solute barometric pressure) shall be reiested and an adjustment for elevation dif-rences between the weather station and ie sampling point shall be applied at a rate ' minus 2.5 mm Hg (0.1 in. Hg) per 30 m 00 ft) elevation increase or vice versa for evation decrease.

2.1.6 Graduated Cylinder and/or Balice. These items are used to measure con-;nsed water and moisture caught in the lica gel to within 1 ml or 0.5 g. Graduated 'linders shall have subdivisions no greater ian 2 ml. Most laboratory balances are ca-ıble of weighing to the nearest 0.5 g or ss. These balances are suitable for use ere.

2.2 Procedure. The following procedure is written for a condenser system (such as the impinger system described in Section 2.1.2) incorporating volumetric analysis to measure the condensed moisture, and silica gel and gravimetric analysis to measure the moisture leaving the condenser.

2.2.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine points shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used in all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to the approval of the Administrator. Select a suitable probe and probe length such that all traverse points can be sampled. Consider sampling from opposite sides of the stack (four total sampling ports) for large stacks, to permit use of shorter probe lengths. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point. Place known volumes of water in the first two impingers. Weigh and record the weight of the silica gel to the nearest 0.5 g, and transfer the silica gel to the fourth impinger; alternatively, the silica gel may first be transferred to the impinger, and the weight of the silica gel plus impinger recorded.

2.2.2 Select a total sampling time such that a minimum total gas volume of 0.60 scm (21 scf) will be collected, at a rate no greater than 0.021 m³/min (0.75 cfm). When both moisture content and pollutant emission rate are to be determined, the moisture determination shall be simultaneous with, and for the same total length of time as, the pollutant emission rate run, unless otherwise specified in an applicable subpart of the standards.

2.2.3 Set up the sampling train as shown in Figure 4-1. Turn on the probe heater and (if applicable) the filter heating system to temperatures of about 120° C (248° F), to prevent water condensation ahead of the condenser; allow time for the temperatures to stabilize. Place crushed ice in the ice bath container. It is recommended, but not required, that a leak check be done, as follows: Disconnect the probe from the first impinger or (if applicable) from the filter holder. Plug the inlet to the first impinger (or filter holder) and pull a 380 mm (15 in.) Hg vacuum; a lower vacuum may be used, provided that it is not exceeded during the test. A leakage rate in excess of 4 percent of the average sampling rate or 0.00057 m³/min (0.02 cfm), whichever is less, is unacceptable. Following the leak check, reconnect the probe to the sampling train.

2.2.4 During the sampling run, maintain a sampling rate within 10 percent of constant rate, or as specified by the Administrator. For each run, record the data re-

FIGURE 4-2—FIELD MOISTURE DETERMINATION REFERENCE METHOD

nt ....
cation ....
erator ....
te ....
n No. ....
bient temperature ....
ometric pressure ....
be length m (ft) ....

SCHEMATIC OF STACK CROSS SECTION

verse point number	Sampling time	Stack temperature	Pressure differential across orifice meter ΔH	Meter reading gas sample volume	ΔV_m	Gas Sample temperature at dry gas meter		Temperature of gas leaving condenser or last impinger
						Inlet	Outlet	
	(θ), min.	°C (°F)	mm (in.) H_2O	m³ (ft³)	m³ (ft³)	($T_{m_{in}}$), °C (°F)	($T_{m_{out}}$), °C (°F)	°C (°F)
tal .... erage					Avg	Avg	Avg	

quired on the example data sheet shown in Figure 4-2. Be sure to record the dry gas meter reading at the beginning and end of each sampling time increment and whenever sampling is halted. Take other appropriate readings at each sample point, at least once during each time increment.

2.2.5 To begin sampling, position the probe tip at the first traverse point. Immediately start the pump and adjust the flow to the desired rate. Traverse the cross section, sampling at each traverse point for an equal length of time. Add more ice and, if necessary, salt to maintain a temperature of less 20° C (68° F) at the silica gel outlet.

2.2.6 After collecting the sample, disconnect the probe from the filter holder (or from the first impinger) and conduct a leak check (mandatory) as described in Section 2.2.3. Record the leak rate. If the leakage rate exceeds the allowable rate, the tester shall either reject the test results or shall correct the sample volume as in Section 6.3 of Method 5. Next, measure the volume of the moisture condensed to the nearest ml. Determine the increase in weight of the silica gel (or silica gel plus impinger) to the nearest 0.5 g. Record this information (see example data sheet, Figure 4-3) and calculate the moisture percentage, as described in 2.3 below.

2.2.7 A quality control check of the volume metering system at the field site is suggested before collecting the sample following the procedure in Method 5, Section 4.4

2.3 Calculations. Carry out the following calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

FIGURE 4-3—ANALYTICAL DATA—REFERENCE METHOD

	Impinger volume, ml	Silica gel weight, g
Final		
Initial		
Difference		

2.3.1 Nomenclature.

B_{ws} = Proportion of water vapor, by volume, in the gas stream.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft³)/(lb-mole) (°R) for English units.

T_m = Absolute temperature at meter, °K (°R).

T_{std} = Standard absolute temperature, 293 K (528°R).

V_m = Dry gas volume measured by dry gas meter, dcm (dcf).

ΔV_m = Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (dcf).

$V_{m(std)}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{wc(std)}$ = Volume of water vapor condensed corrected to standard conditions, scm (scf).

$V_{wsg(std)}$ = Volume of water vapor collected in silica gel corrected to standard conditions, scm (scf).

V_f = Final volume of condenser water, ml.

V_i = Initial volume, if any, of condenser water, ml.

W_f = Final weight of silica gel or silica gel plus impinger, g.

W_i = Initial weight of silica gel or silica gel plus impinger, g.

Y = Dry gas meter calibration factor.

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

2.3.2 Volume of water vapor condensed.

$$V_{wc(std)} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w}$$

$$= K_1(V_f - V_i)$$

Equation 4-1

where:

K_1 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units

2.3.3 Volume of water vapor collected in silica gel.

$$V_{wsg(std)} = \frac{(W_f - W_i) R T_{std}}{P_{std} M_w}$$

$$= K_2(W_f - W_i)$$

Equation 4-2

where:

K_2 = 0.001335 m³/g for metric units
= 0.04715 ft³/g for English units

2.3.4 Sample gas volume.

$$V_{m(std)} = V_m Y \frac{(P_m)(T_{std})}{(P_{std})(T_m)}$$

$$= K_3 Y \frac{V_m P_m}{T_m}$$

Equation 4-3

where:

K_3 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

NOTE: If the post-test lead rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_m in Equation 4-3, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content.

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Equation 4-4

NOTE: In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of B_{ws} shall be considered correct.

2.3.6 Verification of constant sampling rate. For each time increment, determine the ΔV_m. Calculate the average. If the value for any time increment differs from the average by more than 10 percent, reject the results and repeat the run.

3. *Approximation Method*

The approximation method described below is presented only as a suggested method (see Section 1.2).

3.1 Apparatus.

3.1.1 Probe. Stainless steel glass tubing, sufficiently heated to prevent water condensation and equipped with a filter (either in-stack or heated out-stack) to remove particulate matter. A plug of glass wool, inserted into the end of the probe, is a satisfactory filter.

3.1.2 Impingers. Two midget impingers, each with 30 ml capacity, or equivalent.

3.1.3 Ice Bath. Container and ice, to aid in condensing moisture in impingers.

3.1.4 Drying Tube. Tube packed with new or regenerated 6- to 16-mesh indicating-type silica gel (or equivalent desiccant), to dry the sample gas and to protect the meter and pump.

3.1.5 Valve. Needle valve, to regulate the sample gas flow rate.

3.1.6 Pump. Leak-free, diaphragm type, or equivalent, to pull the gas sample through the train.

3.1.7 Volume Meter. Dry gas meter, sufficiently accurate to measure the sample volume within 2%, and calibrated over the range of flow rates and conditions actually encountered during sampling.

3.1.8 Rate Meter. Rotameter, to measure the flow range from 0 to 3 lpm (0 to 0.11 cfm).

3.1.9 Graduated Cylinder. 25 ml.

3.1.10 Barometer. Mercury, aneroid, or other barometer, as described in Section 2.1.5 above.

3.1.11 Vacuum Gauge. At least 760 mm Hg (30 in. Hg) gauge, to be used for the sampling leak check.

3.2 Procedure.

3.2.1 Place exactly 5 ml distilled water in each impinger.

Leak check the sampling train as follows: Temporarily insert a vacuum gauge at or near the probe inlet; then, plug the probe inlet and pull a vacuum of at least 250 mm Hg (10 in. Hg). Note, the time rate of change of the dry gas meter dial; alternatively, a rotameter (0–40 cc/min) may be temporarily attached to the dry gas meter outlet to determine the leakage rate. A leak rate not in excess of 2 percent of the average sampling rate is acceptable.

NOTE: Carefully release the probe inlet plug before turning off the pump.

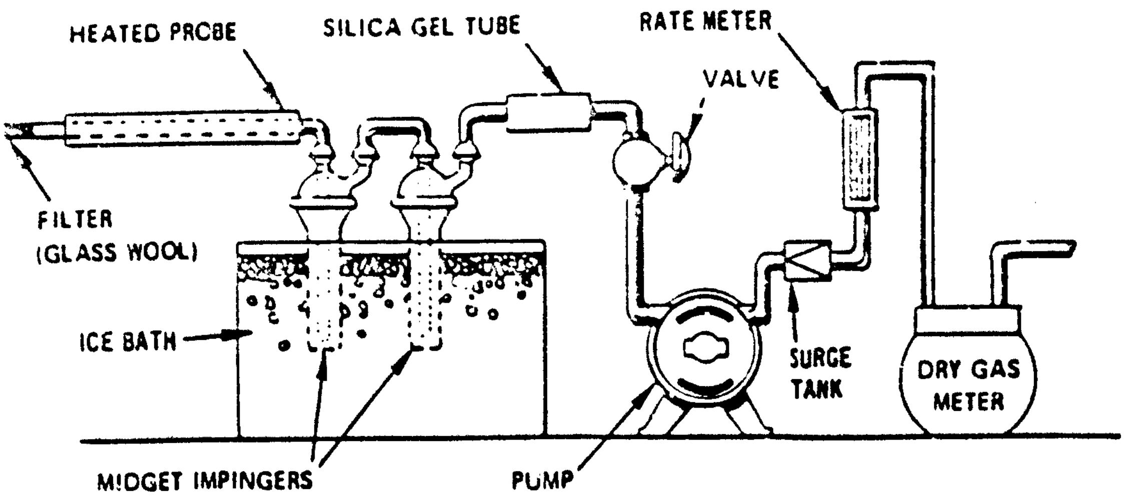

Figure 4-4. Moisture-sampling train - approximation method.

FIGURE 4-5—FIELD MOISTURE DETERMINATION—APPROXIMATION METHOD

Location ______ Comments:
Test ______
Date ______
Operator ______
Barometric pressure ______

Clock time	Gas volume through meter, (Vm), m³ (ft³)	Rate meter setting, m³/min (ft³/min)	Meter temperature, °C (°F)

3.2.2 Connect the probe, insert it into the stack, and sample at a constant rate of 2 lpm (0.071 cfm). Continue sampling until the dry gas meter registers about 30 liters (1.1 ft³) or until visible liquid droplets are carried over from the first impinger to the second. Record temperature, pressure, and dry gas meter readings as required by Figure 4-5.

3.2.3 After collecting the sample, combine the contents of the two impingers and measure the volume to the nearest 0.5 ml.

3.3 Calculations. The calculation method presented is designed to estimate the moisture in the stack gas; therefore, other data, which are only necessary for accurate moisture determinations, are not collected. The following equations adequately estimate the moisture content, for the purpose of determining isokinetic sampling rate settings.

3.3.1 Nomenclature.

B_{wm} = Approximate proportion, by volume, of water vapor in the gas stream leaving the second impinger, 0.025.

B_{ws} = Water vapor in the gas stream, proportion by volume.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter.

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft³)/lb-mole) (°R) for English units.

T_m = Absolute temperature at meter, °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_f = Final volume of impinger contents, ml.

V_i = Initial volume of impinger contents, ml.

V_m = Dry gas volume measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Dry gas volume measured by dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{wc(std)}$ = Volume of water vapor condensed, corrected to standard conditions, scm (scf).

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

Y = Dry gas meter calibration factor.

3.3.2 Volume of water vapor collected.

where:

$$V_{wc} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w}$$

$$= K_1 (V_f - V_i)$$

Equation 4-5

K_1 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units.

3.3.3 Gas volume.

$$V_{m(std)} = V_m \left(\frac{P_m}{P_{std}}\right)\left(\frac{T_{std}}{T_m}\right)$$

$$= K_2 \frac{V_m P_m}{T_m}$$

Equation 4-6

where:

K_2 = 0.3858 °K/mm Hg for metric unit
= 17.64 °R/in. Hg for English units

3.3.4 Approximate moisture conte

$$B_{ws} = \frac{V_{wc}}{V_{wc} + V_{m(std)}} + B_{wm}$$

$$= \frac{V_{wc}}{V_{wc} + V_{m(std)}} + ($$

Equati

4. *Calibration*

4.1 For the reference method, ca equipment as specified in the followi tions of Method 5: Section 5.3 (m systems); Section 5.5 (temperature g and Section 5.7 (barometer). The mended leak check of the metering (Section 5.6 of Method 5) also applies reference method. For the approxi method, use the procedures outlined tion 5.1.1 of Method 6 to calibrate th tering system, and the procedure of M 5, Section 5.7 to calibrate the baromet

5. *Bibliography*

1. Air Pollution Engineering M (Second Edition). Danielson, J. A. (ed. Environmental Protection Agency, Of Air Quality Planning and Standard search Triangle Park, N.C. Publicatio AP-40, 1973.

2. Devorkin, Howard, et al. Air Pol Source Testing Manual. Air Pollution trol District, Los Angeles, Calif. Nov 1963.

3. Methods for Determination of Ve Volume Dust and Mist Content of Western Precipitation Division of Joy ufacturing Co., Los Angeles, Calif. B WP-50, 1968.

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Revision: Final

EPA WIPE SAMPLING TECHNIQUE

SECTION 13

SPECIALIZED SAMPLING TECHNIQUES

13.0 GENERAL

This section discusses several specialized sampling techniques that have been used by contractors on hazardous waste sites. The reader may develop other techniques for specific site needs. In those cases and in cases where the techniques listed here are modified for use on a specific site, careful documentation of the exact procedures used should be provided. This section does not discuss analytical techniques, since analytical methods would vary depending on the data quality objectives, the compounds of concern, the media, and the exact sampling technique. The Contract Laboratory Program plans to issue a "Field Methodology Catalog" in the summer of 1987 that will contain field analytical techniques suitable for analyses of the samples collected by using the techniques in this section.

13.1 WIPE SAMPLING

13.1.1 Scope and Purpose

This guideline discusses the steps required for obtaining a wipe sample. Wipe samples may be used to document the presence of carcinogenic substances or other toxic materials. In addition, wipe sampling is commonly used to ascertain that site or equipment decontamination has been acceptably effective.

13.1.2 Definitions

Site Manager (SM)

The individual responsible for the successful completion of a work assignment within budget and schedule. This person is also referred to as the Site Project Manager or the Project Manager and is typically a contractor's employee (see Subsection 1.1).

Wipe Sample

A sample used to assess surface contamination. The terms "wipe sample," "swipe sample," and "smear sample" have all been used synonymously. For purposes of this section, the sample will be termed "wipe sample."

13.1.3 Applicability

This guideline is applicable when a sample of the substances on a surface is needed. Surfaces may include walls, floors, ceilings, desk tops, equipment, or other large objects that are potentially contaminated.

13.1.4 Responsibilities

The SM or designee is responsible for deciding when wipe sampling is needed.

Field personnel are responsible for performing the actual sampling, maintaining sample integrity, and preparing the proper chain-of-custody forms.

13.1.5 Records

Records of wipe sampling include completed chain-of-custody forms and appropriate entries in the field logbook. If the sample collected is to be analyzed using the National Contract Laboratory Program (CLP), then CLP forms must be completed as discussed in Section 5.

13.1.6 Procedures

Wipe sampling can be an integral part of the overall sampling program. Wipe sampling can help to provide a picture of contaminants that exist on the surface of drums, tanks, equipment, or buildings on a hazardous waste site or that exist in the homes of a populace at risk.

Wipe sampling consists of rubbing a moistened filter paper over a measured area of 100 cm^2 to 1 m^2. The paper is then sent to the laboratory for analysis. The results are related back to the known area of the sample. A proper sampling procedure is essential to ensure a representative, uncontaminated sample.

13.1.6.1 Equipment Required

The following equipment is needed for wipe sampling:

- Whatman 541 filter paper or equivalent, 15 cm
- Disposable, chemical-protective gloves
- Solvent to wet filter paper

13.1.6.2 Wipe Sampling Steps

The steps involved in obtaining a wipe sample are listed below:

- Using a clean, impervious disposable glove, such as a surgeon's glove, remove a filter paper from the box. (**Note:** Although it is necessary to change the glove if it touches the surface being wiped, a new glove should be used for each sample to avoid cross contamination of samples. A new glove should always be used when collecting a new sample.)
- Moisten the filter with a collection medium selected to dissolve the contaminants of concern as specified in the sampling plan. Typically, organic-free water or the solvent used in analysis is used. The filter should be wet but not dripping.
- Thoroughly wipe approximately 1 m^2 of the area with the moistened filter. Using a 1 m^2 stencil will help in judging the size of the wipe area. If a different size area is wiped, record the change in the field logbook. If the surface is not flat, be sure to wipe any crevices or depressions.

- Without allowing the filter to contact any other surface, fold it with the exposed side in, and then fold it over to form a 90-degree angle in the center of the filter.

- Place the filter (angle first) into a clean glass jar, replace the top, seal the jar according to quality assurance requirements, and send the sample to the appropriate laboratory.

- Prepare a blank by moistening a filter with the collection medium. Place the blank in a separate jar, and submit it with the other samples.

- Document the sample collection in the field logbook and on appropriate forms, and ship samples per procedures listed in Section 6.

13.1.7 Region-Specific Variances

No region-specific variances have been identified; however, all future variances will be incorporated in subsequent revision to this compendium. Information on variances may become dated rapidly. Thus, users should contact the regional EPA RPM for full details on current regional practices and requirements.

13.1.8 Information Sources

EBASCO. "Dioxin Sampling." *REM III Program Guidelines*. Prepared for U.S. Environmental Protection Agency. 28 February 1986.

NUS Corporation. "Site-Specific Site Operations Plans." REM/FIT Contract.

13.2 HUMAN HABITATION SAMPLING

13.2.1 Scope and Purpose

This subsection provides general guidance for the planning, method selection, and implementation of sampling activities used to determine the potential for human exposure to contaminants that are present in residential environment.

13.2.2 Definitions

Human Habitation Areas
Any place people may spend extended periods of time, such as their homes or offices.

13.2.3 Applicability

This subsection discusses sampling techniques that are similar in collection methodology to other types of samples, such as environmental soil and water, but are biased to emphasize potential human exposure to contaminants moving into the residential environment.

MODIFIED METHOD LW02

ANALYSIS OF EXPLOSIVES IN SOIL, WIPE, AND RINSATE SAMPLES

ANALYSIS OF EXPLOSIVES IN SOIL, WIPE, AND RINSATE SAMPLES

I. SUMMARY

A. Analytes:

HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
RDX	Hexahydro-1,3,5-trinitro-s-triazine
NB	Nitrobenzene
1,3-DNB	1,3-Dinitrobenzene
1,3,5-TNB	1,3,5-Trinitrobenzene
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
2,4,6-TNT	2,4,6-Trinitrotoluene
Tetryl	2,4,6-Trinitrophenylmethylnitramine

B. Matrix: Extracts from soil, wipe, or rinsate samples.

C. General Method: Sample matrix is extracted with acetonitrile. The extract is diluted with methanol and water, and the resultant solution is injected onto the HPLC for analysis.

D. This method is based on USATHAMA Method LW02, Explosives in Soil.

II. SAFETY INFORMATION

Work in well ventilated areas. Wear adequate protective clothing to avoid skin contact. Wash skin with soap and water thoroughly immediately after contact.

TNB, HMX, RDX, Tetryl, and TNTs are classified as Explosives A by DOT. Avoid extreme temperatures and pressures.

III. APPARATUS AND CHEMICALS

A. Glassware/Hardware

1. Syringes: 10 uL, 50 uL, 100 uL, 1 mL syringe (Hamilton 1005 TEFLL).

2. Vials with teflon-lined caps or septa. Nominal volume of 1.8 mL, 4.0 mL, and 12 mL.

3. B-D Glaspak disposable syringes, 5 mL, with frosted tip.

4. 0.2 micron fluorocarbon filters.

5. Micropipettes, 200 uL.

6. Hypo needles.

7. 2 mL and 20 mL pipette.

8. Whatman #42 ashless 9 cm filter paper.

B. Instrumentation

1. Perkin-Elmer Series 4 High Performance Liquid Chromatograph (HPLC) equipped with a Perkin-Elmer ISS100 Auto-Injector and Micromeritrics Model 786 UV/VIS variable wavelength detector. Hewlett-Packard 3390 recording integrator in peak height mode was used to record data output. Equivalent instrumentation may be substituted.

2. Analytical Balance

   Capable of weighing 0.01 gram for sample preparation and 0.1 mg for standard preparation. Mettler AE 163 or equivalent.

3. Parameters

   a. Columns:

      1) DuPont Zorbax® ODS 4.6 mm i.d. x 25 cm HPLC column with a particle size of 5 to 6 microns.

      2) DuPont Permaphase® ODS guard column (optional).

   b. Mobile Phase:

      50% water
      34% methanol
      16% acetonitrile

   c. Flow: 1.6 mL/min with a pressure of approximately 2860 psig.

   d. Detector: 250 nm

   e. Injection Volume: 50 uL

C. Reagents and SARMs:

1. Acetonitrile, distilled in glass for HPLC use.

2. Methanol, distilled in glass for HPLC use.

3. Water, distilled in glass for HPLC use.

4. USATHAMA Standard Soil.

5. SARMs

HMX SARM No. 1217 (PA 1303)
RDX SARM No. 1130 (PA 1302)
NB SARM No. (PA 1306)
1,3-DNB SARM No. 2250 (PA 1305)
1,3,5-TNB SARM No. 1154 (PA 1300)
2,4-DNT SARM No. 1147 (PA 1298)
2,6-DNT SARM No. 1148 (PA 1299)
2,4,6-TNT SARM No. 1129 (PA 1297)
Tetryl SARM No. 1149 (PA 1301)

IV. CALIBRATION

A. Initial Calibration

1. Preparation of Standards

a. Stock calibration solutions containing approximately 10,000 mg/L of a nitro-compound are prepared by accurately weighing ca. 50 mg of a SARM into a 5-mL serum bottle and dissolving the nitro-compound in 5 mL of acetonitrile pipetted into the bottle. All stock solutions prepared in this manner and stored in a freezer (0°C to -4°C) have remained stable for a period of 6 months.

b. Intermediate Calibration Standards: All compounds appear to be stable for at least 3 months.

1) Intermediate Calibration Standard A (high level): Combine the appropriate volumes of stock calibration standard as shown below. Dilute to 10 mL with acetonitrile and seal with a teflon-lined cap. Store in the dark at 4°C. The resulting solution will have the concentrations indicated in the following table.

Nitro-compound	uL of Stock Cal Std.	Resulting Concentration (ug/mL)
HMX	127	127
RDX	98	98
NB	42	42
1,3-DNB	59	59
1,3,5-TNB	209	209
2,4-DNT	42	42
2,6-DNT	40	40
2,4,6-TNT	192	192
Tetryl	500	500

2) Intermediate Calibration Standard B (low level): 1:10 dilution of the Intermediate Calibration Standard A is made in acetonitrile. Seal with a teflon-lined cap and store in the dark at 4^{o}C. The resulting solution will have the following concentrations:

Nitro-compound	Resulting conc. (ug/mL)
HMX	12.7
RDX	9.80
NB	4.20
1,3-DNB	5.90
1,3,5-TNB	20.9
2,4-DNT	4.20
2,6-DNT	4.00
2,4,6-TNT	19.2
Tetryl	50.0

c. Working Calibration Standards: Using the following table, prepare a series of nine calibration standards. Place the mobile phase into a 1-mL serum vial. Inject the indicated volumes of Intermediate Calibration Standard A or B into the acetonitrile with a microliter syringe. Seal the vial with a teflon-lined septum and cap. Mix well. These solutions are prepared fresh daily and kept in the dark.

WORKING CALIBRATION STANDARDS

Concentration	Intermediate Cal Std A (uL)	Intermediate Cal Std B (uL)	Mobile Phase (uL)
0X	0	0	1,000
0.5X	-	6.25	994
1X	-	12.5	988
2X	-	25	975
5X	-	62.5	938
10X	12.5	-	988
20X	25	-	975
50X	62.5	-	938
100X	125	-	875

2. Daily Calibration

   a. Set up the instrument according to Section IV, Instrumental Analysis.

   b. Analyze mobile phase as a blank to verify a stable baseline.

   c. Analyze the medium calibration standard (10X) to verify peak separation and retention times.

   d. Analyze the calibration standards prepared in Section IV-A-1.

3. Analysis of Calibration Data

   a. Tabulate the calibration standard concentration versus the peak height response for each calibration standard.

   b. Perform a linear regression analysis on the calibration data plotting peak height vs. concentration in ug/mL.

   c. Use the liner regression to obtain analyte concentration for sample response.

4. Calibration Checks

   a. After completion of analyses of samples, a calibration standard at the 10X concentration is analyzed. The response must agree within 25 percent with the daily calibration 10X standard.

b. No certified calibration check standards are available for these compounds.

V. SAMPLE HANDLING STORAGE FOR SOIL, WIPE, AND RINSATE SAMPLES

A. Sampling Procedure: The stability of explosives in soil is not truly known. Precautions should be taken to avoid prolonged exposure to light and heat.

B. Containers: Wide-mouth amber glass bottles with teflon-lined lids.

C. Storage Conditions: Samples should be maintained at 4°C from the time of collection to the time of analysis. No chemical preservatives are necessary.

D. Holding Time Limits: 7 days to extraction; 40 days to anaysis from the time of extraction.

E. Solution Verification: No certified check standards are available.

VI PROCEDURE

A. Soil Analysis

1. Method

a. Accurately weigh 1 gm of soil into a 5-mL serum vial and pipet 2 mL of acetonitrile onto the soil.

b. Place a septum and cap on the vial and shake the vial thoroughly by hand for 2 to 3 minutes.

c. The extract is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a fluorocarbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC.

d. Preparation of sample extracts and spikes for injection is performed the day of analysis.

i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.

ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.

2. Daily Quality Control

a. Perform a spike at 10X the detection limit daily as follows.

i. Accurately weight approximately 1 gm of USATHAMA standard soil into a 5-mL serum vial.

ii. Spike with 100 uL Standard A.

iii. Proceed as in VI-A-1, above.

3. Instrumental Analysis

a. Proceed to Section VII, Instrumental Analysis. The working range for soil samples is listed below.

Calibration Range for Soil Analysis (1X - 100X)

HMX	1.27 - 127	ug
RDX	0.98 - 98.0	ug
NB	0.42 - 42.0	ug
1,3-DNB	0.59 - 59.0	ug
1,3,5-TNB	2.09 - 209	ug
2,4-DNT	0.42 - 42.0	ug
2,6-DNT	0.40 - 40.0	ug
2,4,6-TNT	1.92 - 192	ug
Tetryl	5.00 - 500	ug

b. Samples with analyte concentration exceeding the calibration range will require dilution as necessary.

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B. Wipe Analysis

1. Method

a. Add the filter to a 40-mL vial and pipet 20 mL acetonitrile into the vial.

b. Place a cap on the vial and shake the vial thoroughly by hand for 2 to 3 minutes.

c. The extract is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a flurocarbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC. The remaining extract is disposed as waste.

d. Preparation of sample extracts and spikes for injection is performed the day of analysis.

i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.

ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.

2. Daily Quality Control

a. Perform a spike at 10X the detection limit daily as follows.

i. Place 1/10 of a filter paper into a 5-mL serum vial.

ii. Add 2 mL acetronitrile.

iii. Spike with 100 uL Standard A.

iv. Proceed as in VI-B-1-b, above.

3. Instrumental Analysis

a. Proceed to Section VII, Instrumental Analysis. The working range for wipe samples is listed below.

Calibration Range for Wipe Samples

HMX	12.7 - 1270	total ug/wipe
RDX	9.8 - 980	total ug/wipe
NB	4.2 - 420	total ug/wipe
1,3-DNB	5.9 - 590	total ug/wipe
1,3,5-TNB	20.9 - 2090	total ug/wipe
2,4-DNT	4.2 - 420	total ug/wipe
2,6-DNT	4.0 - 400	total ug/wipe
2,4,6-TNT	19.2 - 1920	total ug/wipe
Tetryl	50.0 - 5000	total ug/wipe

b. Samples with analyte concentration exceeding the calibration range will require dilation as necessary.

C. Rinsate Analysis

1. Method

a. Acetonitrile rinsate is collected from equipment.

b. Measure volume of rinsate.

c. The rinsate is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a fluorocarbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC. The remaining rinsate is disposed as waste.

d. Preparation of sample extracts for injection is performed the day of analysis.

i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.

ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.

2. Daily Quality Control

a. Perform a spike at 10X the detection limit daily as follows:

i. Add 2 mL acetonitrile to a 5-mL serum bottle.

ii. Spike with 100 uL of Standard A.

iii. Proceed as in VI-C-1-c.

3. Instrumental Analysis

a. Proceed to Section VII, Instrumental Analysis. The working range for rinsate samples is described below.

Calibration Range for Rinsate Samples

HMX	0.635 - 63.5	total mg/sample
RDX	0.49 - 49.0	total mg/sample
NB	0.21 - 21.0	total mg/sample
1,3-DNB	0.295 - 29.5	total mg/sample
1,3,5-TNB	1.05 - 105	total mg/sample
2,4-DNT	0.21 - 21.0	total mg/sample
2,6-DNT	0.20 - 20.0	total mg/sample
2,4,6-TNT	0.96 - 96.0	total mg/sample
Tetryl	2.50 - 250	total mg/sample

b. Samples with analyte concentration exceeding the calibration range will require dilation as necessary.

VII. INSTRUMENTAL ANALYSIS

A. Set the chromatographic conditions as follows:

	Time (minutes)	Flow (mL/min.)	Acetonitrile (percent)	Methanol (percent)	Water (Percent)
Equilibrium	3	1.6	16	34	50
Analysis Run	15	1.6	16	34	50

B. Using the auto-injector manufacturer's recommended procedure, introduce 50 uL of the medium level calibration standard into the chromatographic system.

Check the chromatogram to ensure separation of the nitrated toluenes and separation of the nitrobenzene and tetryl. If necessary, adjust the water/methanol ratio of the mobile phase until separate peaks are distinguished. As the column ages, less methanol is required. Generally, the column ages rapidly the first 24 hours, after which it is fairly stable.

C. Once good peak separation is obtained, introduce 50 uL of each working calibration standard and sample into the chromatographic system using the auto-injector manufacturer's recommended procedure.

VIII. CALCULATIONS

A. Soil Samples

1. The diluted extract concentration is read or calculated from the instrument calibration curve.

2. Sample concentration (ug/g) = $\frac{B \times D}{A \times C}$

$$\frac{\text{extract conc (ug/mL)} \times 4 \times B}{A}$$

where:

A = sample weight (dry weight)
B = mL acetonitrile

B. Wipe Samples

Sample Concentration (total ug) = extract conc (ug/mL) x 20 mL x 4

where:

20 mL = total volume
4 = dilution in method

C. Rinse

Sample concentration (total ug) = extract conc (ug/mL) x V x 4

where:

V = total volume
4 = dilution in method

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MODIFIED METHOD FOR NITROCELLULOSE, NITROGLYCERIN, AND PETN IN WATER

1311R2

MODIFIED METHOD OF NITROCELLULOSE, NITROGLYCERIN, AND PETN IN WATER

1. APPLICATION

This method is used to qualitatively determine the concentration of nitrocellulose (NC), nitroglycerine (NC), and PETN in water samples.

A. Tested Concentration Range - Response is linear from 5 to 100 mg/liter in water.

B. Sensitivity Limits - Response for 5 ug of compound is: NC = 0.89, NG = 0.17, PETN = 0.15 absorbance units.

C. Detection Limits -

Compound	Water (ug/L)
NC	9000
NG	5000
PETN	5000

D. Interferences - Nitrite ion will interfere, NC, NG, and PETN cannot be distinguished from each other.

E. Analysis Rate - Approximately 20 samples can be analyzed by one worker in an eight hour day.

2. CHEMISTRY:

Nitrite ion is cleaved from the nitrate ester in basic solution, which diazotizes procaine, in acidic solution, which in turn couples with N, N-dimethyl-1-naphthylamine to produce an azo-dye. This dye is determined from its absorbance at 510 um.

$C_3N_3N_3O_9$ - Trinitroglycerine; glyceryl trinitrate; CAS RN-55-63-0 mp - 13°C, decomposition pt = 145°C;

$C_5N_8N_6O_{12}$ - Pentaerythritol tetranitrate CAS RN-78-11-5 mp - 140°C; explosive decomposition pt. 210°C;

$(C_6N_{12}N_5O_{16})x$ - nitrocellulose, soluble gun cotton, CAS RN-9004-70-0 mp - decomposes on heating.

Handling Hazards: Explosives hazard, avoid heat, shock or open flame. Toxic inhalation and skin absorption hazards exist. Do not handle NG except as a dilute solution.

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3. APPARATUS:

A. Instrumentation - Absorbance measurements are made at 510 nm on a Perkin Elmer Lambda 3 UV/UVS spectrometer equipped with a super sipper.

B. Parameters - N/A

C. Hardware/Glassware

1) 0.1-, 1-, and 2-mL
2) 13 x 100 nm glass test tubes
3) 10-mL volumetric flasks
4) 100-mL volumetric flasks
5) 1-cm spectrometer call (glass)
6) water bath
7) hot plate
8) 25-uL graduated syringe
9) 8-ounce glass bottle
10) 2 dram glass vials

D. Chemicals

1) KOH, Analytical reagent grade
2) Glacial acetic acid, ACS grade
3) Acetone, ACS grade
4) N,N-dimethyl-1-naphthylamine
5) Procaine

E. Reagents

1) 10 percent KOH: Weigh 10.0 g of reagent grade potassium hydroxide into a 100-mL volumetric flask and dilute slowly with deionized water (nitrite free).

2) 20 percent KOH: Same as above except use 20.0 g of KOH.

3) 10 percent acetic acid: Pipette 10.0 mL of glacial acetic acid into a 100-mL volumetric flask that is partially filled with deionized water (nitrite free). Dilute of volume with deionized water.

4) 50 percent acetic acid: Same as above except use 50 mL of glacial acetic acid.

5) Color Developing Reagent: Weigh 0.35 g each of procaine and N,N-dimethyl-1-naphthylamine into a 100-mL volumetric flask and dilute to volume with 50 percent acetic acid-water.

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6) Working Solution of Color Reagent: Pipette 20 mL of the color developing reagent into a 100-mL volumetric flask. Dilute to volume with deionized water (nitrite free).

4. STANDARDS

A. Calibration Standards

1) Stock - Weigh 10.0 mg of NC, PETN, or 1 mL of a 1 percent NC in acetone SARM into a 10.0-mL volumetric flask and dilute to volume with acetone to obtain a 1 ug/ul solution. This solution is refrigerated when not in use.

2) Working - Prepare standard curve daily by adding 0.0, 2.5, 5, 10, 25, and 50 uL of 1 ug/uL stock solution, in duplicate, into 13 mm by 100 mm test tubes, using a 25-uL syringe. Add 0.5 mL of deionized water to each tube and mix thoroughly. This yields concentrations of 0, 5, 10, 20, 50, and 100 ug/mL.

B. Control Spikes - For water samples spike as indicated for the working standards.

5. PROCEDURE:

A. Water Sample Handling/Preparation - Refrigerate the samples until ready for analysis. Prior to analysis, filter through a 0.45 micron Millipore filter and store refrigerated in a 2 dram glass vial.

B. Analysis of Samples

1a) Water - Pipette 0.50 mL of water into a 13 x 100 mm test tube and add 0.50 mL of 20 percent potassium hydroxide solution.

b) Soil - 5 g of air-dried soil is shaken with 5 mL of acetone. The acetone is separated by filtration through a 0.45 u membrane filter (teflon). A 0.5-mL portion of the acetone solution is mixed with 0.5 mL of water and 0.5 mL of 20 percent potassium hydroxide solution.

2) Mix sample well and place in boiling water bath for 30 minutes.

3) Cool the sample; add 2.0 mL of 10 percent acetic acid, and mix.

4) Add 1.0 mL of color developing reagent working solution and mix well.

5) Allow color to develop for 1.5 hours; transfer the solution to a clean, dry spectrophotometer cell and read the absorbance at 510 nm.

6. CALCULATIONS:

Construct a calibration curve of absorbance vs. concentration (ug/L) of the compound of interest (differing response will be observed for NC, PETN, and NG). Determine concentration of compound in samples by interpolating from the calibration curve.

7. REFERENCE:

None.

July 1990
Revision: Final

AMMONIUM PICRATE IN WATER AND WIPE SAMPLES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

1311R2

AMMONIUM PICRATE IN WATER AND WIPE SAMPLES
BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

1. Application

This method is suitable for the determination of ammonium picrate in water and wipe samples. Ammonium picrate is converted to picric acid and quantified in that form.

2. Summary of method

Ammonium picrate is extracted from water or wipe samples with solvent. The extract is concentrated and subjected to high performance liquid chromatography (HPLC) analysis using a reverse phase column and a dual channel ultraviolet detector.

3. Interferences

Any compounds that exhibit chemical and/or physical properties similar to the compounds of interest can interfere.

4. Apparatus

4.1 Concentrator apparatus, a Kuderna-Danish (K-D) concentrator, 500-mL capacity with a 3-ball Snyder column and a 10-mL graduated receiver tube and a 500-mL flask fitted with a 1-ball Snyder column.

4.2 Erlenmeyer flask, 500-mL with a ground glass stopper.

4.3 Evaporative concentrator, Organomation N-Evap, or equivalent.

4.4 Liquid chromatograph, Waters Associates ALC/GPC 204 liquid chromatograph equipped with a dual channel, variable wavelength detector, a model 6000A solvent-delivery system, a model 660 solvent flow programmer, model WISP 710A microprocessor and data module, or equivalents.

4.5 Liquid chromatographic column, a 3.9 mm i.d. by 300 mm long stainless steel column packed with 10 um particle size reverse phase material. Waters Associates u-Bonapak C_{18} column packing or equivalent.

4.6 Separatory funnels, Squibb form, 1-L capacity, or equivalent.

4.7 Solvent clarification kit, Waters Associates 85113, or equivalent.

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4.8 Shaker, a mechanical wrist action shaker.

4.9 Steam bath, a constant temperature steam bath set at 85°C.

5. Reagents

5.1 Acetonitrile, HPLC quality.

5.2 Hydrochloric acid, ACS reagent grade.

5.3 Mobile phase solutions: Prepare the ion pairing, tetrabutylammonium-phosphate solutions for the mobile phase using Waters Associates PIC Reagent A, or equivalent.

5.3.1 Solution A: Add one bottle of PIC reagent A to 1,000 mL of Milli-Q water. Stir for 5 min and then filter through a 0.45-micron filter, type HAWP for aqueous solvents.

5.3.2 Solution B: Add one bottle of PIC reagent A to 1,000 mL acetonitrile. Stir for 5 min and then filter through a 0.45-micron fiter type FHUP for organic solvents.

5.4 Picric acid standards, analytical reference grade or highest purity available. These may be obtained from chemical specialty suppliers or from military sources. Prepare standards at concentrations sufficient to cover the analytical range.

5.5 Separatory funnels, Squibb form, 1-L capacity, or equivalent.

5.6 Solvents, acetone, diethylether, methylene chloride, acetonitrile, pesticide residue quality, distilled in glass, Burdick and Jackson, or equivalent.

5.7 Water, organic-free, HPLC-grade, or water from a Millipore Milli-Q system or equivalent.

6. Procedure

6.1 Procedure for water (rinsate) samples: Samples should be collected according to the recommended practice for the collection of samples for organic analysis (Goerlitz and Brown, 1972). Mercuric chloride (40 ppm) is added as a preservative.

6.1.1 Pour 500 mL water into a 1-L separatory funnel.

6.1.2 Add 3 mL concentrated HCl to the sample contained in the separatory funnel. Check pH to ensure acidity.

6.1.3 Add 75 mL methylene chloride to the sample in the separatory funnel. Stopper and shake for 1 minute. Vent the pressure often. Allow the layers to separate and draw off the methylene chloride layer into a 250-mL Erlenmeyer flask.

6.1.4 Repeat the extraction of the water sample two more times, using 50-mL methylene chloride volumes each time. Combine all the organic extracts in the 250-mL Erlenmeyer, which contains the first extract.

6.1.5 Quantitatively transfer the extract to a 500-mL K-D apparatus fitted with a 3-ball Snyder column and a 20-mL receiver. Add a micro boiling chip and 4 mL of acetonitrile.

6.1.6 Place the appratus on a hot-water bath (approximately 85°C). Reduce the volume of the extract to about 4 mL. Remove the K-D from the heat and allow it to cool.

6.1.7 Use the evaporative concentrator to reduce the volume of solvent to 0.8 to 0.9 mL by directing a stream of nitrogen onto the surface of the liquid while gently warming the receiver in a water bath.

6.1.8 Perform one method blank and three sample spikes at 40 ppb, 200 ppb, and 200 ppb with each batch of 20 samples.

6.1.9 Proceed to HPLC analysis (6.3).

6.2 Procedure for wipe samples

6.2.1 Add wipe sample to 40-mL vial.

6.2.2 Add 20 mL distilled water.

6.2.3 Shake 15 minutes using wrist-action shaker.

6.2.4 Decant water into 500-mL separatory funnel.

6.2.5 Repeat extraction twice, using 20 mL distilled water each time.

6.2.6 Add 440 mL distilled water to separator funnel.

6.2.7 Perform one method blank and three sample spikes of 20 ug, 100 ug, and 100 ug with each batch.

6.2.8 Proceed as in 6.1.2 under "Procedure for Water (Rinsate) Samples."

6.3 Analysis by high pressure liquid chromatography.

6.3.1 The following chromatographic conditions have been found to be suitable for this analysis:

Mobile Phase: The separation is made under isocratic conditions. Combine 36 percent solution A with 64 percent solution B by using the solvent programmer.

Isocratic 36 percent acetonitrile + PIC reagent A + PICA/64 percent H_2O + PIC reagent A.

Flow Rate: 1.10 mL/min

Detector Sensitivity:

UV 254 nm 0.005 A units full scale

6.3.3 Daily calibration is performed over the following range of concentrations using picric acid as the standard material.

Standard Concentration (ng/uL)	Corresponding Ammonium Picrate in Water (ug/L)	Corresponding Ammonium Picrate in Wipe (total ug)
10	20	10
20	40	20
50	100	50
100	200	100
200	400	200
500	1000	500
1000	2000	1000

6.3.4 Add 0.1 mL of PIC reagent A to the samples, mix and make up to a volume of 1.0 mL; allow samples to stand 10 minutes and inject 10 uL into the liquid chromatographic system. Record the volume injected. Identify the peaks by retention time. Dilute any extract containing an identifiable component above the calibration range to bring it within that range.

7. Calculations

7.1 Determine sample concentration from daily calibration curve using Least Squares Fit (LSF).

7.2 Water sample concentration is calculated as follows:

$$ng/uL \times EV \times \frac{1\ ug}{1000\ ng} \div SV = ug/L$$

where:

ng/uL = picric acid concentration in extract, from LSF.
EV = extract volume, in uL.
SV = sample volume, in Liters.

Note that picric acid concentration must be converted to ammonium picrate concentration by using the ratios of molecular weights.

7.3 Wipe sample concentration (total ug) is calculated as follows:

$$ng/uL \times EV \times \frac{1\ ug}{1000\ ng} = total\ ug$$

where:

ng/uL = picric acid concentration in extract, from LSF.
EV = extract volume.

Note that picric acid concentration must be converted to ammonium picrate concentration by using the ratios of molecular weights.

References

Goerlitz, D.F. and Law, L.M., Gas chromatographic method for the analysis of TNT and RDX explosives contaminating water and soil-core material, U.S. Geological Survey open file report 75-182.

Goerlitz, D.F., 1978, Direct analysis of RDX and TNT in water by high-pressure liquid chromatography, U.S. Geological Survey open file report 79--.

Goerlitz, D.F., 1978, High-performance liquid chromatography method for the analysis of picric acid in water, U.S. Geological Survey open file report.

EPA MODIFIED METHOD 5

MODIFIED METHOD 5 SAMPLING TRAIN

METHOD 0010

MODIFIED METHOD 5 SAMPLING TRAIN

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to the determination of Destruction and Removal Efficiency (DRE) of semivolatile Principal Organic Hazardous Compounds (POHCs) from incineration systems (PHS, 1967). This method also may be used to determine particulate emission rates from stationary sources as per EPA Method 5 (see References at end of this method).

2.0 SUMMARY OF METHOD

2.1 Gaseous and particulate pollutants are withdrawn from an emission source at an isokinetic sampling rate and are collected in a multicomponent sampling train. Principal components of the train include a high-efficiency glass- or quartz-fiber filter and a packed bed of porous polymeric adsorbent resin. The filter is used to collect organic-laden particulate materials and the porous polymeric resin to adsorb semivolatile organic species. Semivolatile species are defined as compounds with boiling points >100°C.

2.2 Comprehensive chemical analyses of the collected sample are conducted to determine the concentration and identity of the organic materials.

3.0 INTERFERENCES

3.1 Oxides of nitrogen (NO_x) are possible interferents in the determination of certain water-soluble compounds such as dioxane, phenol, and urethane; reaction of these compounds with NO_x in the presence of moisture will reduce their concentration. Other possibilities that could result in positive or negative bias are (1) stability of the compounds in methylene chloride, (2) the formation of water-soluble organic salts on the resin in the presence of moisture, and (3) the solvent extraction efficiency of water-soluble compounds from aqueous media. Use of two or more ions per compound for qualitative and quantitative analysis can overcome interference at one mass. These concerns should be addressed on a compound-by-compound basis before using this method.

4.0 APPARATUS AND MATERIALS

4.1 Sampling train:

4.1.1 A schematic of the sampling train used in this method is shown in Figure 1. This sampling train configuration is adapted from EPA Method 5 procedures, and, as such, the majority of the required equipment

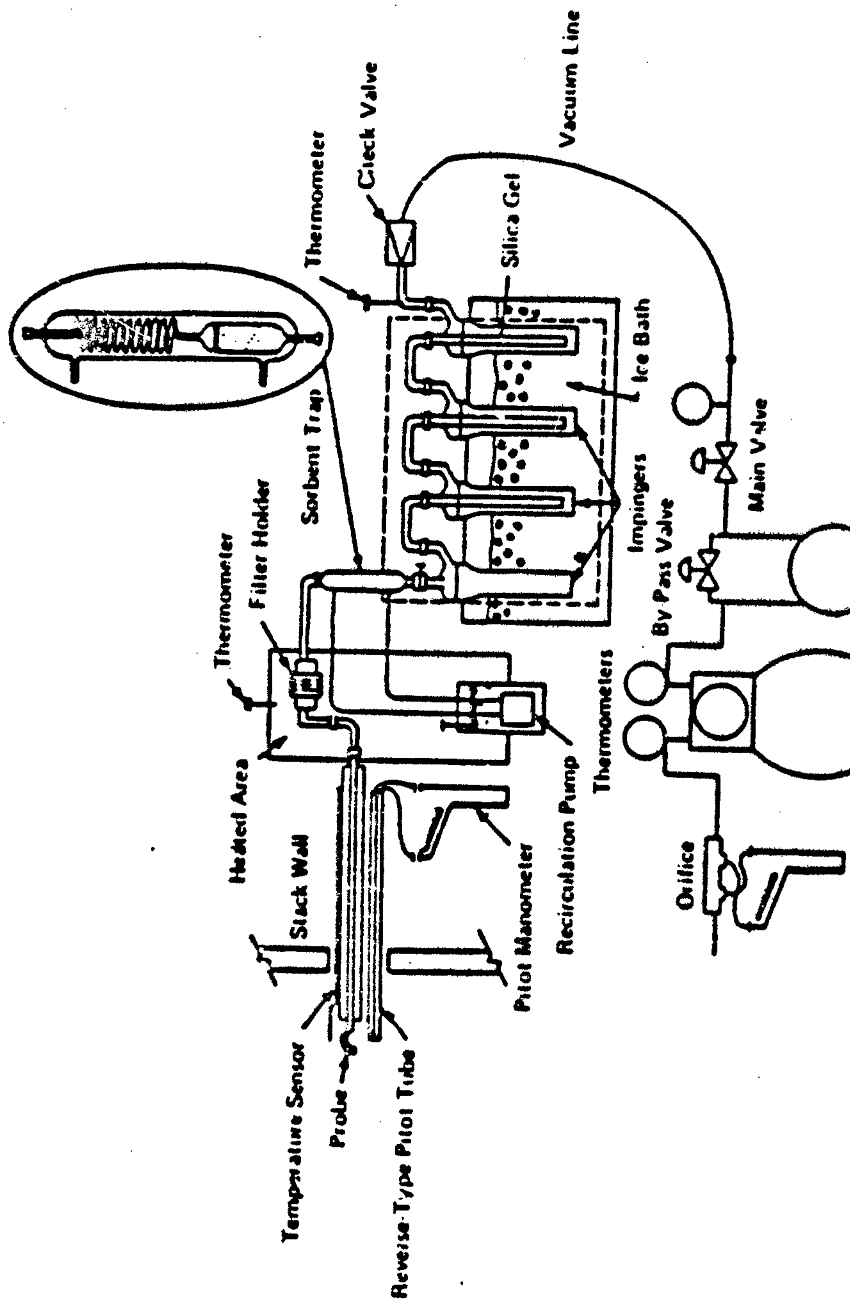


Figure 1. Modified Method 5 Sampling Train.

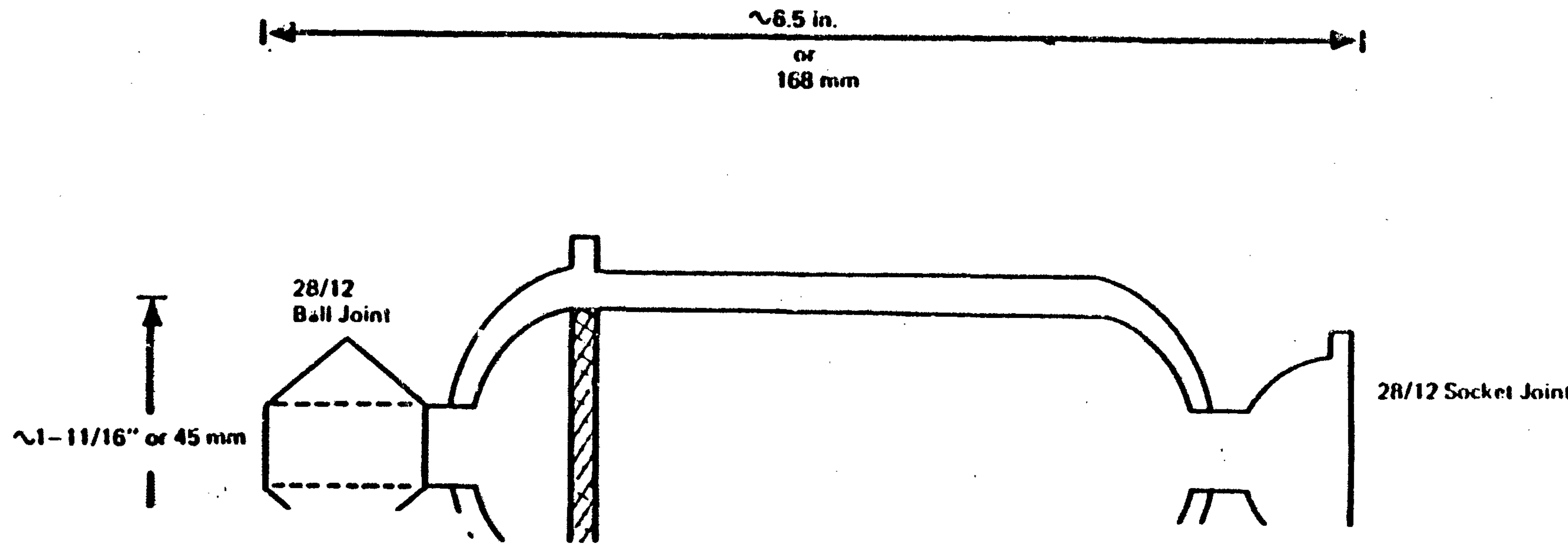
complete organic module are not currently available, but may be assembled from commercially available laboratory glassware and a custom-fabricated sorbent trap. Details of two acceptable designs are shown in Figures 2 and 3 (the thermocouple well is shown in Figure 2).

4.1.3.8 Impinger train: To determine the stack-gas moisture content, four 500-mL impingers, connected in series with leak-free ground-glass joints, follow the knockout trap. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3-cm (1/2-in.) I.D. glass tube extending about 1.3 cm (1/2 in.) from the bottom of the outer cylinder. The second impinger shall be of the Greenburg-Smith design with the standard tip. The first and second impingers shall contain known quantities of water or appropriate trapping solution. The third shall be empty or charged with a caustic solution, should the stack gas contain hydrochloric acid (HCl). The fourth shall contain a known weight of silica gel or equivalent desiccant.

4.1.3.9 Metering system: The necessary components are a vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (5.4°F), dry-gas meter capable of measuring volume to within 1%, and related equipment, as shown in Figure 1. At a minimum, the pump should be capable of 4 cfm free flow, and the dry-gas meter should have a recording capacity of 0-999.9 cu ft with a resolution of 0.005 cu ft. Other metering systems capable of maintaining sampling rates within 10% of isokineticity and of determining sample volumes to within 2% may be used. The metering system must be used in conjunction with a pitot tube to enable checks of isokinetic sampling rates. Sampling trains using metering systems designed for flow rates higher than those described in APTD-0581 and APTD-0576 may be used, provided that the specifications of this method are met.

4.1.3.10 Barometer: Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) is requested and an adjustment for elevation differences between the weather station and sampling point is applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30-m (100 ft) elevation increase (vice versa for elevation decrease).

4.1.3.11 Gas density determination equipment: Temperature sensor and pressure gauge (as described in Sections 2.3 and 2.4 of EPA Method 2), and gas analyzer, if necessary (as described in EPA Method 3). The temperature sensor ideally should be permanently attached to the pitot tube or sampling probe in a fixed configuration such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal.


~6.5 in.
or
168 mm
28/12
Ball Joint
~1-11/16" or 45 mm
28/12 Socket Joint

is identical to that used in EPA Method 5 determinations. The new components required are a condenser coil and a sorbent module, which are used to collect semivolatile organic materials that pass through the glass- or quartz-fiber filter in the gas phase.

4.1.2 Construction details for the basic train components are given in APTD-0581 (see Martin, 1971, in Section 13.0, References); commercial models of this equipment are also available. Specifications for the sorbent module are provided in the following subsections. Additionally, the following subsections list changes to APTD-0581 and identify allowable train configuration modifications.

4.1.3 Basic operating and maintenance procedures for the sampling train are described in APTD-0576 (see Rom, 1972, in Section 13.0, References). As correct usage is important in obtaining valid results, all users should refer to APTD-0576 and adopt the operating and maintenance procedures outlined therein unless otherwise specified. The sampling train consists of the components detailed below.

4.1.3.1 Probe nozzle: Stainless steel (316) or glass with sharp, tapered (30° angle) leading edge. The taper shall be on the outside to preserve a constant I.D. The nozzle shall be buttonhook or elbow design and constructed from seamless tubing (if made of stainless steel). Other construction materials may be considered for particular applications. A range of nozzle sizes suitable for isokinetic sampling should be available in increments of 0.16 cm (1/16 in.), e.g., 0.32-1.27 cm (1/8-1/2 in.), or larger if higher volume sampling trains are used. Each nozzle shall be calibrated according to the procedures outlined in Paragraph 9.1.

4.1.3.2 Probe liner: Borosilicate or quartz-glass tubing with a heating system capable of maintaining a gas temperature of 120 ± 14°C (248 ± 25°F) at the exit end during sampling. (The tester may opt to operate the equipment at a temperature lower than that specified.) Because the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) are considered acceptable. Either borosilicate or quartz-glass probe liners may be used for stack temperatures up to about 480°C (900°F). Quartz liners shall be used for temperatures between 480 and 900°C (900 and 1650°F). (The softening temperature for borosilicate is 820°C (1508°F), and for quartz 1500°C (2732°F).) Water-cooling of the stainless steel sheath will be necessary at temperatures approaching and exceeding 500°C.

4.1.3.3 Pitot tube: Type S, as described in Section 2.1 of EPA Method 2, or other appropriate devices (Vollaro, 1976). The pitot tube shall be attached to the probe to allow constant monitoring of the stack-gas velocity. The impact (high-pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see EPA Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of EPA Method 2.

4.1.3.4 Differential pressure gauge: Inclined manometer or equivalent device as described in Section 2.2 of EPA Method 2. One manometer shall be used for velocity-head (ΔP) readings and the other for orifice differential pressure (ΔH) readings.

4.1.3.5 Filter holder: Borosilicate glass, with a glass frit filter support and a sealing gasket. The sealing gasket should be made of materials that will not introduce organic material into the gas stream at the temperature at which the filter holder will be maintained. The gasket shall be constructed of Teflon or materials of equal or better characteristics. The holder design shall provide a positive seal against leakage at any point along the filter circumference. The holder shall be attached immediately to the outlet of the cyclone or cyclone bypass.

4.1.3.6 Filter heating system: Any heating system capable of maintaining a temperature of 120 ± 14°C (248 ± 25°F) around the filter holder during sampling. Other temperatures may be appropriate for particular applications. Alternatively, the tester may opt to operate the equipment at temperatures other than that specified. A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

4.1.3.7 Organic sampling module: This unit consists of three sections, including a gas-conditioning section, a sorbent trap, and a condensate knockout trap. The gas-conditioning system shall be capable of conditioning the gas leaving the back half of the filter holder to a temperature not exceeding 20°C (68°F). The sorbent trap shall be sized to contain approximately 20 g of porous polymeric resin (Rohm and Haas XAD-2 or equivalent) and shall be jacketed to maintain the internal gas temperature at 17 ± 3°C (62.5 ± 5.4°F). The most commonly used coolant is ice water from the impinger ice-water bath, constantly circulated through the outer jacket, using rubber or plastic tubing and a peristaltic pump. The sorbent trap should be outfitted with a glass well or depression, appropriately sized to accommodate a small thermocouple in the trap for monitoring the gas entry temperature. The condensate knockout trap shall be of sufficient size to collect the condensate following gas conditioning. The organic module components shall be oriented to direct the flow of condensate formed vertically downward from the conditioning section, through the adsorbent media, and into the condensate knockout trap. The knockout trap is usually similar in appearance to an empty impinger directly underneath the sorbent module; it may be oversized but should have a shortened center stem (at a minimum, one-half the length of the normal impinger stems) to collect a large volume of condensate without bubbling and overflowing into the impinger train. All surfaces of the organic module wetted by the gas sample shall be fabricated of borosilicate glass, Teflon, or other inert materials. Commercial versions of the

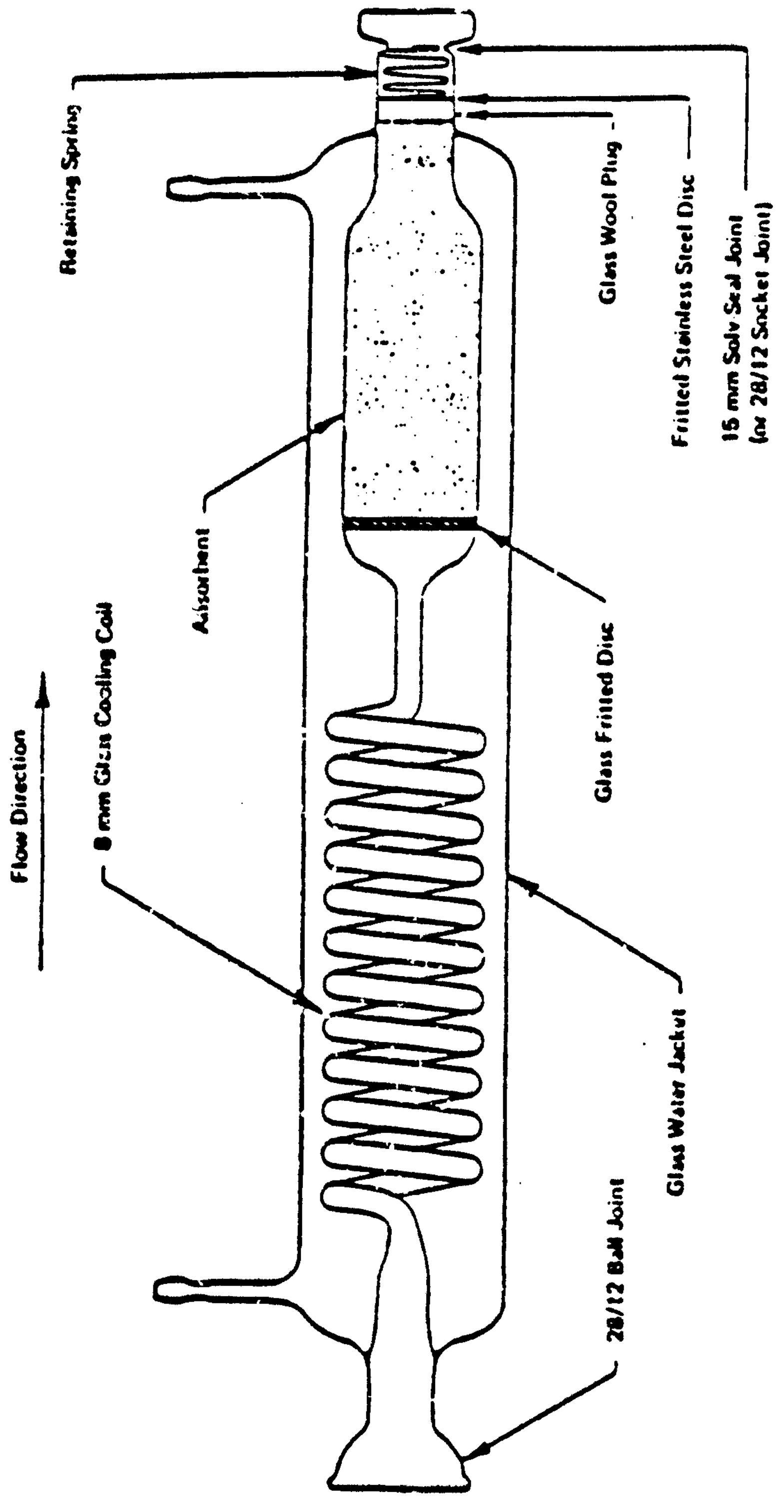


Figure 3. Adsorbent Sampling System.

Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see EPA Method 2, Figure 2-7). As a second alternative, if a difference of no more than 1% in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube.

4.1.3.12 Calibration/field-preparation record: A permanently bound laboratory notebook, in which duplicate copies of data may be made as they are being recorded, is required for documenting and recording calibrations and preparation procedures (i.e., filter and silica gel tare weights, clean XAD-2, quality assurance/quality control check results, dry-gas meter, and thermocouple calibrations, etc.). The duplicate copies should be detachable and should be stored separately in the test program archives.

4.2 Sample Recovery:

4.2.1 Probe liner: Probe nozzle and organic module conditioning section brushes; nylon bristle brushes with stainless steel wire handles are required. The probe brush shall have extensions of stainless steel, Teflon, or inert material at least as long as the probe. The brushes shall be properly sized and shaped to brush out the probe liner, the probe nozzle, and the organic module conditioning section.

4.2.2 Wash bottles: Three. Teflon or glass wash bottles are recommended; polyethylene wash bottles should not be used because organic contaminants may be extracted by exposure to organic solvents used for sample recovery.

4.2.3 Glass sample storage containers: Chemically resistant, borosilicate amber and clear glass bottles, 500-mL or 1,000-mL. Bottles should be tinted to prevent action of light on sample. Screw-cap liners shall be either Teflon or constructed so as to be leak-free and resistant to chemical attack by organic recovery solvents. Narrow-mouth glass bottles have been found to exhibit less tendency toward leakage.

4.2.4 Petri dishes: Glass, sealed around the circumference with wide (1-in.) Teflon tape, for storage and transport of filter samples.

4.2.5 Graduated cylinder and/or balances: To measure condensed water to the nearest 1 mL or 1 g. Graduated cylinders shall have subdivisions not >2 mL. Laboratory triple-beam balances capable of weighing to $\pm$0.5 g or better are required.

4.2.6 Plastic storage containers: Screw-cap polypropylene or polyethylene containers to store silica gel.

4.2.7 Funnel and rubber policeman: To aid in transfer of silica gel to container (not necessary if silica gel is weighed in field).

4.2.8 Funnels: Glass, to aid in sample recovery.

4.3 Filters: Glass- or quartz-fiber filters, without organic binder, exhibiting at least 99.95% efficiency (<0.05% penetration) on 0.3-um dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D2986-71. Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO_2 or SO_3, the filter material must be of a type that is unreactive to SO_2 or SO_3. Reeve Angel 934 AH or Schleicher and Schwell #3 filters work well under these conditions.

4.4 Crushed ice: Quantities ranging from 10-50 lb may be necessary during a sampling run, depending on ambient air temperature.

4.5 Stopcock grease: Solvent-insoluble, heat-stable silicone grease. Use of silicone grease upstream of the module is not permitted, and amounts used on components located downstream of the organic module shall be minimized. Silicone grease usage is not necessary if screw-on connectors and Teflon sleeves or ground-glass joints are used.

4.6 Glass wool: Used to plug the unfritted end of the sorbent module. The glass-wool fiber should be solvent-extracted with methylene chloride in a Soxhlet extractor for 12 hr and air-dried prior to use.

5.0 REAGENTS

5.1 Adsorbent resin: Porous polymeric resin (XAD-2 or equivalent) is recommended. These resins shall be cleaned prior to their use for sample collection. Appendix A of this method should be consulted to determine appropriate precleaning procedure. For best results, resin used should not exhibit a blank of higher than 4 mg/kg of total chromatographable organics (TCO) (see Appendix B) prior to use. Once cleaned, resin should be stored in an airtight, wide-mouth amber glass container with a Teflon-lined cap or placed in one of the glass sorbent modules tightly sealed with Teflon film and elastic bands. The resin should be used within 4 wk of the preparation.

5.2 Silica gel: Indicating type, 6-16 mesh. If previously used, dry at 175°C (350°F) for 2 hr before using. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

5.3 Impinger solutions: Distilled organic-free water (Type II) shall be used, unless sampling is intended to quantify a particular inorganic gaseous species. If sampling is intended to quantify the concentration of additional species, the impinger solution of choice shall be subject to Administrator approval. This water should be prescreened for any compounds of interest. One hundred mL will be added to the specified impinger; the third impinger in the train may be charged with a basic solution (1 N sodium hydroxide or sodium acetate) to protect the sampling pump from acidic gases. Sodium acetate should be used when large sample volumes are anticipated because sodium hydroxide will react with carbon dioxide in aqueous media to form sodium carbonate, which may possibly plug the impinger.

5.4 <u>Sample recovery reagents</u>:

5.4.1 Methylene chloride: Distilled-in-glass grade is required for sample recovery and cleanup (see Note to 5.4.2 below).

5.4.2 Methyl alcohol: Distilled-in-glass grade is required for sample recovery and cleanup.

NOTE: Organic solvents from metal containers may have a high residue blank and should not be used. Sometimes suppliers transfer solvents from metal to glass bottles; thus blanks shall be run prior to field use and only solvents with low blank value ($<0.001\%$) shall be used.

5.4.3 Water: Water (Type II) shall be used for rinsing the organic module and condenser component.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 Because of complexity of this method, field personnel should be trained in and experienced with the test procedures in order to obtain reliable results.

6.2 <u>Laboratory preparation</u>:

6.2.1 All the components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified.

6.2.2 Weigh several 200- to 300-g portions of silica gel in airtight containers to the nearest 0.5 g. Record on each container the total weight of the silica gel plus containers. As an alternative to preweighing the silica gel, it may instead be weighed directly in the impinger or sampling holder just prior to train assembly.

6.2.3 Check filters visually against light for irregularities and flaws or pinhole leaks. Label the shipping containers (glass Petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

6.2.4 Desiccate the filters at $20 \pm 5.6°C$ ($68 \pm 10°F$) and ambient pressure for at least 24 hr, and weigh at intervals of at least 6 hr to a constant weight (i.e., <0.5-mg change from previous weighing), recording results to the nearest 0.1 mg. During each weighing the filter must not be exposed for more than a 2-min period to the laboratory atmosphere and relative humidity above 50%. Alternatively (unless otherwise specified by the Administrator), the filters may be oven-dried at 105°C (220°F) for 2-3 hr, desiccated for 2 hr, and weighed.

6.3 <u>Preliminary field determinations</u>:

6.3.1 Select the sampling site and the minimum number of sampling points according to EPA Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and range of velocity heads using EPA Method 2. It is recommended that a leak-check of the pitot lines (see EPA Method 2, Section 3.1) be performed. Determine the stack-gas moisture content using EPA Approximation Method 4 or its alternatives to establish estimates of isokinetic sampling-rate settings. Determine the stack-gas dry molecular weight, as described in EPA Method 2, Section 3.6. If integrated EPA Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the sample run.

6.3.2 Select a nozzle size based on the range of velocity heads so that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of EPA Method 2).

6.3.3 Select a suitable probe liner and probe length so that all traverse points can be sampled. For large stacks, to reduce the length of the probe, consider sampling from opposite sides of the stack.

6.3.4 A minimum of 3 dscm (105.9 dscf) of sample volume is required for the determination of the Destruction and Removal Efficiency (DRE) of POHCs from incineration systems. Additional sample volume shall be collected as necessitated by analytical detection limit constraints. To determine the minimum sample volume required, refer to sample calculations in Section 10.0.

6.3.5 Determine the total length of sampling time needed to obtain the identified minimum volume by comparing the anticipated average sampling rate with the volume requirement. Allocate the same time to all traverse points defined by EPA Method 1. To avoid timekeeping errors, the length of time sampled at each traverse point should be an integer or an integer plus one-half min.

6.3.6 In some circumstances (e.g., batch cycles) it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas-sample volumes. In these cases, the Administrator's approval must first be obtained.

6.4 <u>Preparation of collection train</u>:

6.4.1 During preparation and assembly of the sampling train, keep all openings where contamination can occur covered with Teflon film or aluminum foil until just prior to assembly or until sampling is about to begin.

6.4.2 Fill the sorbent trap section of the organic module with approximately 20 g of clean adsorbent resin. While filling, ensure that the trap packs uniformly, to eliminate the possibility of channeling. When freshly cleaned, many adsorbent resins carry a static charge, which will cause clinging to trap walls. This may be minimized by filling the trap in the presence of an antistatic device. Commercial antistatic devices include Model-204 and Model-210 manufactured by the 3M Company, St. Paul, Minnesota.

6.4.3 If an impinger train is used to collect moisture, place 100 mL of water in each of the first two impingers, leave the third impinger empty (or charge with caustic solution, as necessary), and transfer approximately 200-300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

6.4.4 Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

6.4.5 When glass liners are used, install the selected nozzle using a Viton-A O-ring when stack temperatures are <260°C (500°F) and a woven glass-fiber gasket when temperatures are higher. See APTD-0576 (Rom, 1972) for details. Other connecting systems utilizing either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above, or by a leak-free direct mechanical connection. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

6.4.6 Set up the train as in Figure 1. During assembly, do not use any silicone grease on ground-glass joints that are located upstream of the organic module. A very light coating of silicone grease may be used on all ground-glass joints that are located downstream of the organic module, but it should be limited to the outer portion (see APTD-0576) of the ground-glass joints to minimize silicone-grease contamination. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and the filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack. The organic module condenser must be maintained at a temperature of 17 ± 3°C. Connect all temperature sensors to an appropriate potentiometer/display unit. Check all temperature sensors at ambient temperature.

6.4.7 Place crushed ice around the impingers and the organic module condensate knockout.

6.4.8 Turn on the sorbent module and condenser coil coolant recirculating pump and begin monitoring the sorbent module gas entry temperature. Ensure proper sorbent module gas entry temperature before proceeding and again before any sampling is initiated. It is extremely important that the XAD-2 resin temperature never exceed 50°C (122°F), because thermal decomposition will occur. During testing, the XAD-2 temperature must not exceed 20°C (68°F) for efficient capture of the semivolatile species of interest.

6.4.9 Turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize.

6.5 Leak-check procedures

6.5.1 Pre-test leak-check:

6.5.1.1 Because the number of additional intercomponent connections in the Semi-VOST train (over the M5 Train) increases the possibility of leakage, a pre-test leak-check is required.

6.5.1.2 After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 381-mm Hg (15-in. Hg) vacuum.
(NOTE: A lower vacuum may be used, provided that it is not exceeded during the test.)

6.5.1.3 If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first attaching a carbon-filled leak-check impinger (shown in Figure 4) to the inlet of the filter holder (cyclone, if applicable) and then plugging the inlet and pulling a 381-mm Hg (15-in. Hg) vacuum. (Again, a lower vacuum may be used, provided that it is not exceeded during the test.) Then, connect the probe to the train and leak-check at about 25-mm Hg (1-in. Hg) vacuum; alternatively, leak-check the probe with the rest of the sampling train in one step at 381-mm Hg (15-in. Hg) vacuum. Leakage rates in excess of 4% of the average sampling rate or >0.00057 m^3/min (0.02 cfm), whichever is less, are unacceptable.

6.5.1.4 The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with fine-adjust valve fully open and coarse-adjust valve completely closed. Partially open the coarse-adjust valve and slowly close the fine-adjust valve until the desired vacuum is reached. Do not reverse direction of the fine-adjust valve; this will cause water to back up into the organic module. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check, as shown below, and start over.

CROSS SECTIONAL VIEW

Leak Testing Apparatus

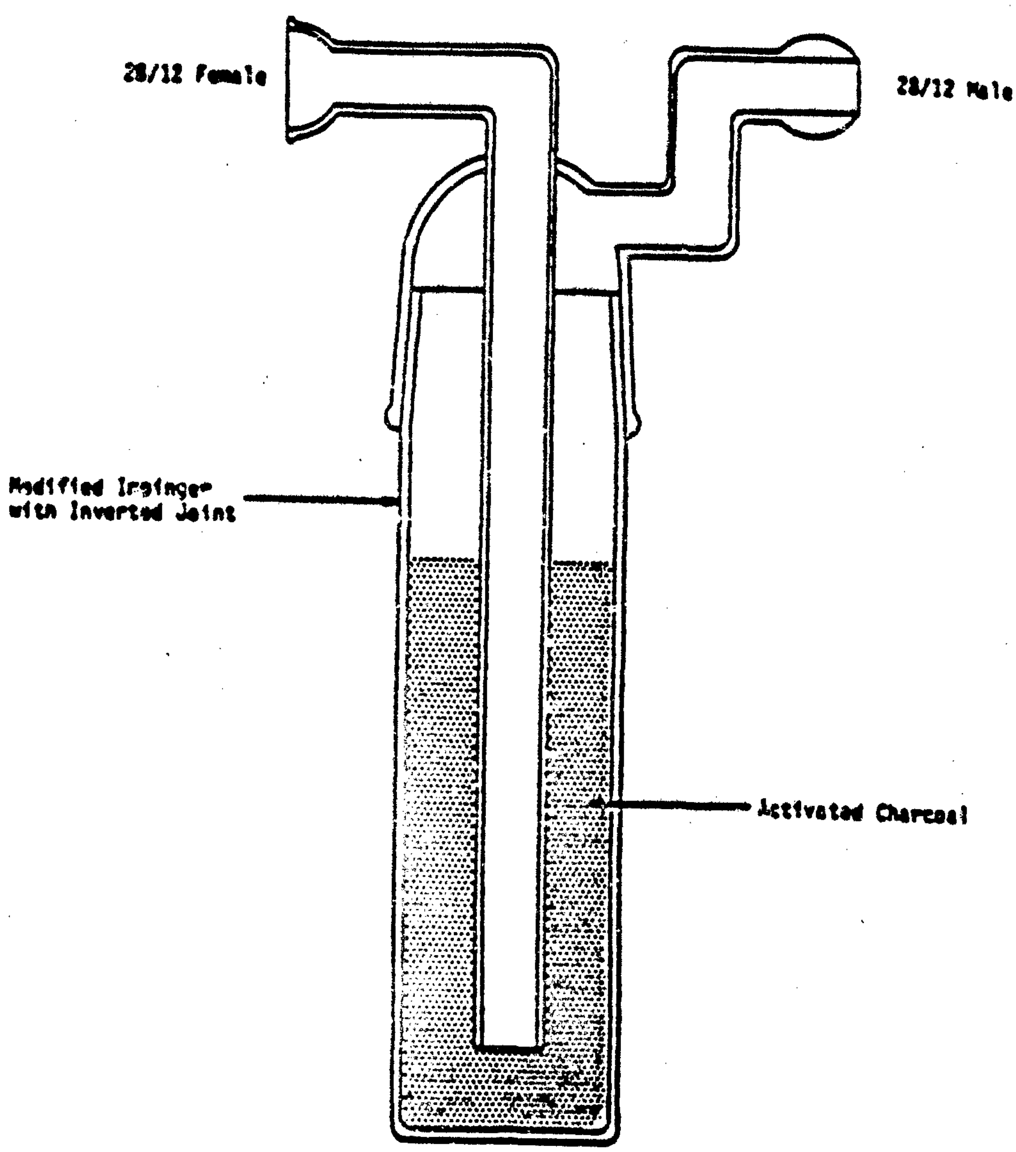


Figure 4. Leak-check impinger.

6.5.1.5 When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable). When the vacuum drops to 127 mm (5 in.) Hg or less, immediately close the coarse-adjust valve. Switch off the pumping system and reopen the fine-adjust valve. Do not reopen the fine-adjust valve until the coarse-adjust valve has been closed. This prevents the water in the impingers from being forced backward into the organic module and silica gel from being entrained backward into the third impinger.

6.5.2 Leak-checks during sampling run:

6.5.2.1 If, during the sampling run, a component (e.g., filter assembly, impinger, or sorbent trap) change becomes necessary, a leak-check shall be conducted immediately after the interruption of sampling and before the change is made. The leak-check shall be done according to the procedure outlined in Paragraph 6.5.1, except that it shall be done at a vacuum greater than or equal to the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered. If a higher leakage rate is obtained, the tester shall void the sampling run. (It should be noted that any "correction" of the sample volume by calculation by calculation reduces the integrity of the pollutant concentrations data generated and must be avoided.)

6.5.2.2 Immediately after a component change, and before sampling is reinitiated, a leak-check similar to a pre-test leak-check must also be conducted.

6.5.3 Post-test leak-check:

6.5.3.1 A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done with the same procedures as those with the pre-test leak-check, except that it shall be conducted at a vacuum greater than or equal to the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate, correct the sample volume (as shown in the calculation section of this method), and consider the data obtained of questionable reliability, or void the sampling run.

6.6 Sampling-train operation:

6.6.1 During the sampling run, maintain an isokinetic sampling rate to within 10% of true isokinetic, unless otherwise specified by the Administrator. Maintain a temperature around the filter of 120 ± 14°C (248 ± 25°F) and a gas temperature entering the sorbent trap at a maximum of 20°C (68°F).

6.6.2 For each run, record the data required on a data sheet such as the one shown in Figure 5. Be sure to record the initial dry-gas meter reading. Record the dry-gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted. Take other readings required by Figure 5 at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity-head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

6.6.3 Clean the stack access ports prior to the test run to eliminate the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are at the specified temperature, and verify that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point, with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations, are available. These nomographs are designed for use when the Type S pitot-tube coefficient is 0.84 ± 0.02 and the stack-gas equivalent density (dry molecular weight) is equal to 29 ± 4. APTD-0576 details the procedure for using the nomographs. If the stack-gas molecular weight and the pitot-tube coefficient are outside the above ranges, do not use the nomographs unless appropriate steps (Shigehara, 1974) are taken to compensate for the deviations.

6.6.4 When the stack is under significant negative pressure (equivalent to the height of the impinger stem), take care to close the coarse-adjust valve before inserting the probe into the stack, to prevent water from backing into the organic module. If necessary, the pump may be turned on with the coarse-adjust valve closed.

6.6.5 When the probe is in position, block off the openings around the probe and stack access port to prevent unrepresentative dilution of the gas stream.

6.6.6 Traverse the stack cross section, as required by EPA Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the access port, in order to minimize the chance of extracting deposited material.

6.6.7 During the test run, make periodic adjustments to keep the temperature around the filter holder and the organic module at the proper levels; add more ice and, if necessary, salt to maintain a temperature of <20°C (68°F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

Plant ______
Location ______
Operator ______
Date ______
Run No. ______
Sample Box No. ______
Meter Box No. ______
Meter ΔH@ ______
C Factor ______
Pitot Tube Coefficient C_p ______

Schematic of Stack Cross Section

Ambient Temperature ______
Barometric Pressure ______
Assumed Moisture % ______
Probe Length, m (ft) ______
Nozzle Identification No. ______
Average Calibrated Nozzle Diameter, cm (in) ______
Probe Heater Setting ______
Leak Rate, m^3/min, (cfm) ______
Probe Liner Material ______
Static Pressure, mm Hg (in. Hg) ______
Filter No. ______

Traverse Point Number	Sampling Time (θ) min.	Vacuum mm Hg (in. Hg)	Stack Temperature (T_S) °C(°F)	Velocity Head (P_S) mm (in) H_2O	Pressure Differential Across Orifice Meter mm (H_2O) (in H_2O)	Gas Sample Volume m^3 (ft^3)	Gas Sample Temp. at Dry Gas Meter Inlet °C(°F)	Gas Sample Temp. at Dry Gas Meter Outlet °C(°F)	Filter Holder Temperature °C(°F)	Temperature of Gas Entering Sorbent Trap °C(°F)	Temperature of Gas Leaving Condenser or Last Impinger
Total							Avg.	Avg.			
Average											

Figure 5. Particulate field data.

6.6.8 If the pressure drop across the filter or sorbent trap becomes too high, making isokinetic sampling difficult to maintain, the filter/sorbent trap may be replaced in the midst of a sample run. Using another complete filter holder/sorbent trap assembly is recommended, rather than attempting to change the filter and resin themselves. After a new filter/sorbent trap assembly is installed, conduct a leak-check. The total particulate weight shall include the summation of all filter assembly catches.

6.6.9 A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

6.6.10 Note that when two or more trains are used, separate analysis of the front-half (if applicable) organic-module and impinger (if applicable) catches from each train shall be performed, unless identical nozzle sizes were used on all trains. In that case, the front-half catches from the individual trains may be combined (as may the impinger catches), and one analysis of front-half catch and one analysis of impinger catch may be performed.

6.6.11 At the end of the sample run, turn off the coarse-adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry-gas meter reading, and conduct a post-test leak-check. Also, leak-check the pitot lines as described in EPA Method 2. The lines must pass this leak-check in order to validate the velocity-head data.

6.6.12 Calculate percent isokineticity (see Section 10.8) to determine whether the run was valid or another test run should be made.

7.0 SAMPLE RECOVERY

7.1 Preparation:

7.1.1 Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over the tip to prevent losing or gaining particulate matter. Do not cap the probe tip tightly while the sampling train is cooling down because this will create a vacuum in the filter holder, drawing water from the impingers into the sorbent module.

7.1.2 Before moving the sample train to the cleanup site, remove the probe from the sample train and cap the open outlet, being careful not to lose any condensate that might be present. Cap the filter inlet.

Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the organic module and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the organic module.

7.1.3 Cap the filter-holder outlet and the inlet to the organic module. Separate the sorbent trap section of the organic module from the condensate knockout trap and the gas-conditioning section. Cap all organic module openings. Disconnect the organic-module knockout trap from the impinger train inlet and cap both of these openings. Ground-glass stoppers, Teflon caps, or caps of other inert materials may be used to seal all openings.

7.1.4 Transfer the probe, the filter, the organic-module components, and the impinger/condenser assembly to the cleanup area. This area should be clean and protected from the weather to minimize sample contamination or loss.

7.1.5 Save a portion of all washing solutions (methanol/methylene chloride, Type II water) used for cleanup as a blank. Transfer 200 mL of each solution directly from the wash bottle being used and place each in a separate, prelabeled glass sample container.

7.1.6 Inspect the train prior to and during disassembly and note any abnormal conditions.

7.2 Sample containers:

7.2.1 Container no. 1: Carefully remove the filter from the filter holder and place it in its identified Petri dish container. Use a pair or pairs of tweezers to handle the filter. If it is necessary to fold the filter, ensure that the particulate cake is inside the fold. Carefully transfer to the Petri dish any particulate matter or filter fibers that adhere to the filter-holder gasket, using a dry nylon bristle brush or sharp-edged blade, or both. Label the container and seal with 1-in.-wide Teflon tape around the circumference of the lid.

7.2.2 Container no. 2: Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components first with methanol/methylene chloride (1:1 v/v) into a glass container. Distilled water may also be used. Retain a water and solvent blank and analyze in the same manner as with the samples. Perform rinses as follows:

7.2.2.1 Carefully remove the probe nozzle and clean the inside surface by rinsing with the solvent mixture (1:1 v/v methanol/-methylene chloride) from a wash bottle and brushing with a nylon bristle brush. Brush until the rinse shows no visible particles; then make a final rinse of the inside surface with the solvent mix. Brush and rinse the inside parts of the Swagelok fitting with the solvent mix in a similar way until no visible particles remain.

7.2.2.2 Have two people rinse the probe liner with the solven mix by tilting and rotating the probe while squirting solvent int its upper end so that all inside surfaces will be wetted wit solvent. Let the solvent drain from the lower end into the sampl container. A glass funnel may be used to aid in transferring liqui washes to the container.

7.2.2.3 Follow the solvent rinse with a probe brush. Hold the probe in an inclined position and squirt solvent into the upper enc while pushing the probe brush through the probe with a twisting action; place a sample container underneath the lower end of the probe and catch any solvent and particulate matter that is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the solvent or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above-prescribed manner at least six times (metal probes have small crevices in which particulate matter can be entrapped). Rinse the brush with solvent and quantitatively collect these washings in the sample container. After the brushing, make a final solvent rinse of the probe as described above.

7.2.2.4 It is recommended that two people work together to clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

7.2.2.5 Clean the inside of the front half of the filter holder and cyclone/cyclone flask, if used, by rubbing the surfaces with a nylon bristle brush and rinsing with methanol/methylene chloride (1:1 v/v) mixture. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone and cyclone flask (if applicable). Brush and rinse any particulate material adhering to the inner surfaces of these components into the front-half rinse sample. After all solvent washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that solvent will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to identify its contents.

7.2.3 Container no. 3: The sorbent trap section of the organic module may be used as a sample transport container, or the spent resin may be transferred to a separate glass bottle for shipment. If the sorbent trap itself is used as the transport container, both ends should be sealed with tightly fitting caps or plugs. Ground-glass stoppers or Teflon caps may be used. The sorbent trap should then be labeled, covered with aluminum foil, and packaged on ice for transport to the laboratory. If a separate bottle is used, the spent resin should be quantitatively transferred from the trap into the clean bottle. Resin that adheres to the walls of the trap should be recovered using a rubber policeman or spatula and added to this bottle.

7.2.4 Container no. 4: Measure the volume of condensate collected in the condensate knockout section of the organic module to within ±1 mL by using a graduated cylinder or by weighing to within ±0.5 g using a triple-beam balance. Record the volume or weight of liquid present and note any discoloration or film in the liquid catch. Transfer this liquid to a prelabeled glass sample container. Inspect the back half of the filter housing and the gas-conditioning section of the organic module. If condensate is observed, transfer it to a graduated or weighing bottle and measure the volume, as described above. Add this material to the condensate knockout-trap catch.

7.2.5 Container no. 5: All sampling train components located between the high-efficiency glass- or quartz-fiber filter and the first wet impinger or the final condenser system (including the heated Teflon line connecting the filter outlet to the condenser) should be thoroughly rinsed with methanol/methylene chloride (1:1 v/v) and the rinsings combined. This rinse shall be separated from the condensate. If the spent resin is transferred from the sorbent trap to a separate sample container for transport, the sorbent trap shall be thoroughly rinsed until all sample-wetted surfaces appear clean. Visible films should be removed by brushing. Whenever train components are brushed, the brush should be subsequently rinsed with solvent mixture and the rinsings added to this container.

7.2.6 Container no. 6: Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere strongly to the impinger wall. Because the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, weigh the container and its contents to 0.5 g or better.

7.3 Impinger water:

7.3.1 Make a notation of any color or film in the liquid catch. Measure the liquid in the first three impingers to within ±1 mL by using a graduated cylinder or by weighing it to within ±0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

7.3.2 Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Paragraph 4.1.3.7). Amber glass containers should be used for storage of impinger catch, if required.

7.3.3 If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

7.4 Sample preparation for shipment: Prior to shipment, recheck al sample containers to ensure that the caps are well secured. Seal the lids o all containers around the circumference with Teflon tape. Ship all liqui samples upright on ice and all particulate filters with the particulate catc facing upward. The particulate filters should be shipped unrefrigerated.

8.0 ANALYSIS

8.1 Sample preparation:

8.1.1 General: The preparation steps for all samples will resul in a finite volume of concentrated solvent. The final sample volum (usually in the 1- to 10-mL range) is then subjected to analysis b GC/MS. All samples should be inspected and the appearance documented All samples are to be spiked with surrogate standards as received fro the field prior to any sample manipulations. The spike should be at level equivalent to 10 times the MDL when the solvent is reduced i volume to the desired level (i.e., 10 mL). The spiking compounds shoul be the stable isotopically labeled analog of the compounds of interest o a compound that would exhibit properties similar to the compounds o interest, be easily chromatographed, and not interfere with the analysi of the compounds of interest. Suggested surrogate spiking compounds are: deuterated naphthalene, chrysene, phenol, nitrobenzene, chlorobenzene, toluene, and carbon-13-labeled pentachlorophenol.

8.1.2 Condensate: The "condensate" is the moisture collected ir the first impinger following the XAD-2 module. Spike the condensate with the surrogate standards. The volume is measured and recorded and then transferred to a separatory funnel. The pH is to be adjusted to pH 2 with 6 N sulfuric acid, if necessary. The sample container and graduated cylinder are sequentially rinsed with three successive 10-mL aliquots of the extraction solvent and added to the separatory funnel. The ratio of solvent to aqueous sample should be maintained at 1:3. Extract the sample by vigorously shaking the separatory funnel for 5 min. After complete separation of the phases, remove the solvent and transfer to a Kuderna-Danish concentrator (K-D), filtering through a bed of precleaned, dry sodium sulfate. Repeat the extraction step two additional times. Adjust the pH to 11 with 6 N sodium hydroxide and reextract combining the acid and base extracts. Rinse the sodium sulfate into the K-D with fresh solvent and discard the desiccant. Add Teflon boiling chips and concentrate to 10 mL by reducing the volume to slightly less than 10 mL and then bringing to volume with fresh solvent. In order to achieve the necessary detection limit, the sample volume can be further reduced to 1 mL by using a micro column K-D or nitrogen blow-down. Should the sample start to exhibit precipitation, the concentration step should be stopped and the sample redissolved with fresh solvent taking the volume to some finite amount. After adding a standard (for the purpose of quantitation by GC/MS), the sample is ready for analysis, as discussed in Paragraph 8.2.

8.1.3 Impinger: Spike the sample with the surrogate standards; measure and record the volume and transfer to a separatory funnel. Proceed as described in Paragraph 8.1.2.

8.1.4 XAD-2: Spike the resin directly with the surrogate standards. Transfer the resin to the all-glass thimbles by the following procedure (care should be taken so as not to contaminate the thimble by touching it with anything other than tweezers or other solvent-rinsed mechanical holding devices). Suspend the XAD-2 module directly over the thimble. The glass frit of the module (see Figure 2) should be in the up position. The thimble is contained in a clean beaker, which will serve to catch the solvent rinses. Using a Teflon squeeze bottle, flush the XAD-2 into the thimble. Thoroughly rinse the glass module with solvent into the beaker containing the thimble. Add the XAD-2 glass-wool plug to the thimble. Cover the XAD-2 in the thimble with a precleaned glass-wool plug sufficient to prevent the resin from floating into the solvent reservoir of the extractor. If the resin is wet, effective extraction can be accomplished by loosely packing the resin in the thimble. If a question arises concerning the completeness of the extraction, a second extraction, without a spike, is advised. The thimble is placed in the extractor and the rinse solvent contained in the beaker is added to the solvent reservoir. Additional solvent is added to make the reservoir approximately two-thirds full. Add Teflon boiling chips and assemble the apparatus. Adjust the heat source to cause the extractor to cycle 5-6 times per hr. Extract the resin for 16 hr. Transfer the solvent and three 10-mL rinses of the reservoir to a K-D and concentrate as described in Paragraph 8.1.2.

8.1.5 Particulate filter (and cyclone catch): If particulate loading is to be determined, weigh the filter (and cyclone catch, if applicable). The particulate filter (and cyclone catch, if applicable) is transferred to the glass thimble and extracted simultaneously with the XAD-2 resin.

8.1.6 Train solvent rinses: All train rinses (i.e., probe, impinger, filter housing) using the extraction solvent and methanol are returned to the laboratory as a single sample. If the rinses are contained in more than one container, the intended spike is divided equally among the containers proportioned from a single syringe volume. Transfer the rinse to a separatory funnel and add a sufficient amount of organic-free water so that the methylene chloride becomes immiscible and its volume no longer increases with the addition of more water. The extraction and concentration steps are then performed as described in Paragraph 8.1.2.

8.2 Sample analysis:

8.2.1 The primary analytical tool for the measurement of emissions from hazardous waste incinerators is GC/MS using fused-silica capillary GC columns, as described in Method 8270 in Chapter Four of this manual. Because of the nature of GC/MS instrumentation and the cost associated

with sample analysis, prescreening of the sample extracts by (chromatography/flame ionization detection (GC/FID) or with elect: capture (GC/ECD) is encouraged. Information regarding the complexity ; concentration level of a sample prior to GC/MS analysis can be enormous help. This information can be obtained by using eitl capillary columns or less expensive packed columns. However, the F screen should be performed with a column similar to that used with t GC/MS. Keep in mind that GC/FID has a slightly lower detection lin than GC/MS and, therefore, that the concentration of the sample can adjusted either up or down prior to analysis by GC/MS.

8.2.2 The mass spectrometer will be operated in a full scan (4 450) mode for most of the analyses. The range for which data a acquired in a GC/MS run will be sufficiently broad to encompass the maj ions, as listed in Chapter Four, Method 8270, for each of the designat POHCs in an incinerator effluent analysis.

8.2.3 For most purposes, electron ionization (EI) spectra will collected because a majority of the POHCs give reasonable EI spectr Also, EI spectra are compatible with the NBS Library of Mass Spectra a other mass spectral references, which aid in the identification proce for other components in the incinerator process streams.

8.2.4 To clarify some identifications, chemical ionization (C spectra using either positive ions or negative ions will be used elucidate molecular-weight information and simplify the fragmentati(patterns of some compounds. In no case, however, should CI spectra alo(be used for compound identification. Refer to Chapter Four, Method 827(for complete descriptions of GC conditions, MS conditions, ar quantitative and quantitative identification.

9.0 CALIBRATION

9.1 Probe nozzle: Probe nozzles shall be calibrated before thei initial use in the field. Using a micrometer, measure the inside diameter c the nozzle to the nearest 0.025 mm (0.001 in.). Make measurements at thre separate places across the diameter and obtain the average of th measurements. The difference between the high and low numbers shall no exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded they shall be reshaped, sharpened, and recalibrated before use. Each nozz! shall be permanently and uniquely identified.

9.2 Pitot tube: The Type S pitot tube assembly shall be calibrate according to the procedure outlined in Section 4 of EPA Method 2, or assigne(a nominal coefficient of 0.84 if it is not visibly nicked, dented, or corrode(and if it meets design and intercomponent spacing specifications.

9.3 Metering system:

9.3.1 Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry-gas meter dial readings to correspond to the wet-test meter readings, calibration factors may be used to correct the gas meter dial readings mathematically to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: Make a 10-min calibration run at 0.00057 m^3/min (0.02 cfm); at the end of the run, take the difference of the measured wet-test and dry-gas meter volumes and divide the difference by 10 to get the leak rate. The leak rate should not exceed 0.00057 m^3/min (0.02 cfm).

9.3.2 After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). The vacuum shall be set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet-test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5%, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

9.3.3 Leak-check of metering system: That portion of the sampling train from the pump to the orifice meter (see Figure 1) should be leak-checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 6): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13-18 cm (5-7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for 1 min. A loss of pressure on the manometer indicates a leak in the meter box. Leaks, if present, must be corrected.

NOTE: If the dry-gas-meter coefficient values obtained before and after a test series differ by >5%, either the test series shall be voided or calculations for test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

9.4 Probe heater: The probe-heating system shall be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

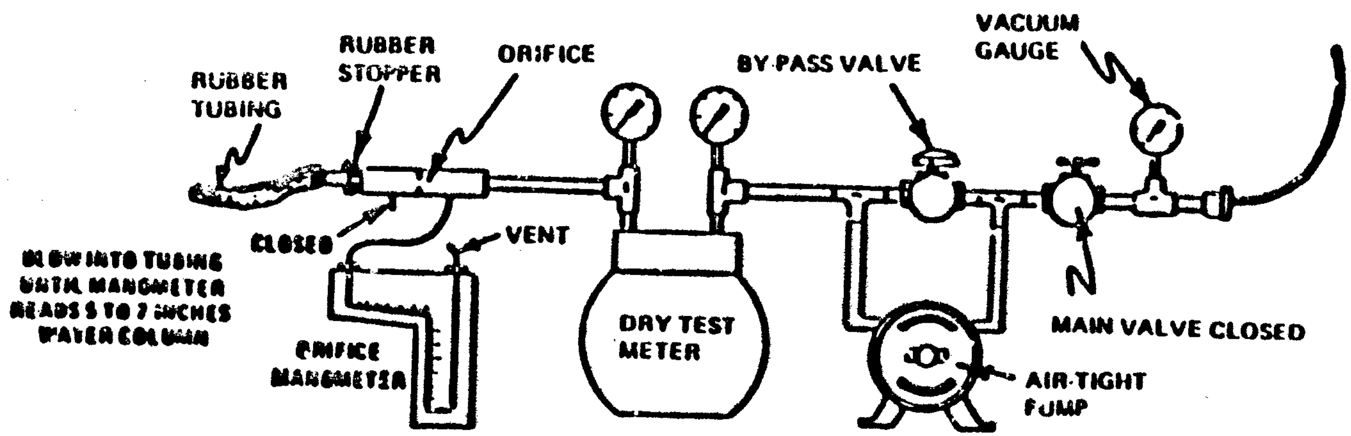


Figure 8. Leak-check of meter box.

9.5 Temperature gauges: Each thermocouple must be permanently and uniquely marked on the casting; all mercury-in-glass reference thermometers must conform to ASTM E-1 63C or 63F specifications. Thermocouples should be calibrated in the laboratory with and without the use of extension leads. If extension leads are used in the field, the thermocouple readings at ambient air temperatures, with and without the extension lead, must be noted and recorded. Correction is necessary if the use of an extension lead produces a change >1.5%.

9.5.1 **Impinger, organic module, and dry-gas meter thermocouples:** For the thermocouples used to measure the temperature of the gas leaving the impinger train and the XAD-2 resin bed, three-point calibration at ice-water, room-air, and boiling-water temperatures is necessary. Accept the thermocouples only if the readings at all three temperatures agree to $\pm 2°C$ (3.6°F) with those of the absolute value of the reference thermometer.

9.5.2 **Probe and stack thermocouple:** For the thermocouples used to indicate the probe and stack temperatures, a three-point calibration at ice-water, boiling-water, and hot-oil-bath temperatures must be performed; it is recommended that room-air temperature be added, and that the thermometer and the thermocouple agree to within 1.5% at each of the calibration points. A calibration curve (equation) may be constructed (calculated) and the data extrapolated to cover the entire temperature range suggested by the manufacturer.

9.6 Barometer: Adjust the barometer initially and before each test series to agree to within ± 25 mm Hg (0.1 in. Hg) of the mercury barometer or the corrected barometric pressure value reported by a nearby National Weather Service Station (same altitude above sea level).

9.7 Triple-beam balance: Calibrate the triple-beam balance before each test series, using Class-S standard weights; the weights must be within $\pm 0.5\%$ of the standards, or the balance must be adjusted to meet these limits.

10.0 CALCULATIONS

10.1 Carry out calculations. Round off figures after the final calculation to the correct number of significant figures.

10.2 Nomenclature:

A_n = Cross-sectional area of nozzle, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_d = Type S pitot tube coefficient (nominally 0.84 ± 0.02), dimensionless.

I = Percent of isokinetic sampling.

L_a = Maximum acceptable leakage rate for a leak-check, either pre-tes or following a component change; equal to 0.00057 m^3/min (0.C cfm) or 4% of the average sampling rate, whichever is less.

L_i = Individual leakage rate observed during the leak-check conducted prior to the "i^{th}" component change (i = 1, 2, 3...n) m^3/min (cfm).

L_p = Leakage rate observed during the post-test leak-check, m^3/min (cfm).

M_d = Stack-gas dry molecular weight, g/g-mole (lb/lb-mole).

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack-gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 mm Hg-m^3/K-g-mole (21.85 in. Hg-ft^3/°R-lb-mole).

T_m = Absolute average dry-gas meter temperature (see Figure 6), K (°R).

T_s = Absolute average stack-gas temperature (see Figure 6), K (°R).

T_{std} = Standard absolute temperature, 293K (528°R).

V_{lc} = Total volume of liquid collected in the organic module condensate knockout trap, the impingers, and silica gel, mL.

V_m = Volume of gas sample as measured by dry-gas meter, dscm (dscf).

$V_{m(std)}$ = Volume of gas sample measured by the dry-gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

V_s = Stack-gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

γ = Dry-gas-meter calibration factor, dimensionless.

ΔH = Average pressure differential across the orifice meter (see Figure 2), mm H_2O (in. H_2O).

ρ_w = Density of water, 0.9982 g/mL (0.002201 lb/mL).

θ = Total sampling time, min.

θ_1 = Sampling time interval from the beginning of a run until the first component change, min.

θ_i = Sampling time interval between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p = Sampling time interval from the final (n^{th}) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = sec/min.

100 = Conversion to percent.

10.3 Average dry-gas-meter temperature and average orifice pressure drop: See data sheet (Figure 5, above).

10.4 Dry-gas volume: Correct the sample measured by the dry-gas meter to standard conditions (20°C, 760 mm Hg [68°F, 29.92 in. Hg]) by using Equation 1:

$$V_{m(std)} = V_m \gamma \frac{T_{std}}{T_m} \frac{P_{bar} + \Delta H/13.6}{P_{std}} = K_1 V_m \gamma \frac{P_{bar} + \Delta H/13.6}{T_m} \qquad (1)$$

where:

K_1 = 0.3858 K/mm Hg for metric units, or
K_1 = 17.64°R/in. Hg for English units.

It should be noted that Equation 1 can be used as written, unless the leakage rate observed during any of the mandatory leak-checks (i.e., the post-test leak-check or leak-checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 1 must be modified as follows:

a. Case I (no component changes made during sampling run): Replace V_m in Equation 1 with the expression:

$$V_m - (L_p - L_a)$$

B-

b. Case II (one or more component changes made during the sampling run): Replace V_m in Equation 1 by the expression:

$$V_m - (L_1 - L_a)\theta_1 - \sum_{i=2}^{n} (L_i - L_a)\theta_i - (L_p - L_a)\theta_p$$

and substitute only for those leakage rates (L_i or L_p) that exceed L_a.

10.5 Volume of water vapor:

$$V_{w(std)} = V_{1c} \frac{P_w}{M_w} \frac{RT_{std}}{P_{std}} = K_2 V_{1c} \quad (2)$$

where:

K_2 = 0.001333 m^3/mL for metric units, or
K_2 = 0.04707 ft^3/mL for English units.

10.6 Moisture content:

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}} \quad (3)$$

NOTE: In saturated or water-droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 3) and a second from the assumption of saturated conditions. The lower of the two values of B_w shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note to Section 1.2 of Method 4. For the purposes of this method, the average stack-gas temperature from Figure 6 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1°C (2°F).

10.7 Conversion factors:

From	To	Multiply by
scf	m^3	0.02832
g/ft^3	gr/ft^3	15.43
g/ft^3	lb/ft^3	2.205×10^{-3}
g/ft^3	g/m^3	35.31

10.3 Isokinetic variation:

10.3.1 Calculation from raw data:

$$I = \frac{100\ T_s[K_3 V_{lc} + (V_m/T_m)(P_{bar} + \Delta H/13.6)]}{60 \theta V_s P_s A_n} \qquad (4)$$

where:

K_3 = 0.003454 mm Hg-m^3/mL-K for metric units, or
K_3 = 0.002669 in. Hg-ft^3/mL-°R for English units.

10.3.2 Calculation for intermediate values:

$$I = \frac{T_s V_{m(std)} P_{std} 100}{T_{std} V_s \theta A_n P_s 60(1-B_{ws})} \qquad (5)$$

$$= K_4 \frac{T_s V_{m(std)}}{P_s V_s A_n \theta (1-B_{ws})}$$

where:

K_4 = 4.320 for metric units, or
K_4 = 0.09450 for English units.

10.3.3 Acceptable results: If 90% $\leq$ I $\leq$ 110%, the results are acceptable. If the results are low in comparison with the standard and I is beyond the acceptable range, or if I is less than 90%, the Administrator may opt to accept the results.

10.9 To determine the minimum sample volume that shall be collected, the following sequence of calculations shall be used.

10.9.1 From prior analysis of the waste feed, the concentration of POHCs introduced into the combustion system can be calculated. The degree of destruction and removal efficiency that is required is used to determine the maximum amount of POHC allowed to be present in the effluent. This may be expressed as:

$$\frac{(WF)\ (POHC_i\ \text{conc})}{100}\ \frac{(100\text{-}\%DRE)}{100} = \text{Max POHC}_i\ \text{Mass} \qquad (6)$$

where:

WF = mass flow rate of waste feed per hr, g/hr (lb/hr).

$POHC_i$ = concentration of Principal Organic Hazardous Compound (wt %) introduced into the combustion process.

DRE = percent Destruction and Removal Efficiency required.

Max POHC = mass flow rate (g/hr [lb/hr]) of POHC emitted from the combustion source.

10.9.2 The average discharge concentration of the POHC in the effluent gas is determined by comparing the Max POHC with the volumetric flow rate being exhausted from the source. Volumetric flow rate data are available as a result of preliminary Method 1-4 determinations:

$$\frac{\text{Max POHC}_i \text{ Mass}}{DV_{eff(std)}} = \text{Max POHC}_i \text{ conc} \qquad (7)$$

where:

$DV_{eff(std)}$ = volumetric flow rate of exhaust gas, dscm (dscf).

$POHC_i$ conc = anticipated concentration of the POHC in the exhaust gas stream, g/dscm (lb/dscf).

10.9.3 In making this calculation, it is recommended that a safety margin of at least ten be included:

$$\frac{LDL_{POHC} \times 10}{POHC_i \text{ conc}} = V_{TBC} \qquad (8)$$

where:

LDL_{POHC} = detectable amount of POHC in entire sampling train.
NOTE: The whole extract from an XAD-2 cartridge is seldom if ever, injected at once. Therefore, if aliquoting factors are involved, the LDL_{POHC} is not the same as the analytical (or column) detection limit.

V_{TBC} = minimum dry standard volume to be collected at dry-gas meter.

10.10 <u>Concentration of any given POHC in the gaseous emissions of a combustion process:</u>

1) Multiply the concentration of the POHC as determined in Method 8270 by the final concentration volume, typically 10 mL.

C_{POHC} (ug/mL) x sample volume (mL) = amount (ug) of POHC in sample (9)

where:

C_{POHC} = concentration of POHC as analyzed by Method 8270.

2) Sum the amount of POHC found in all samples associated with a single train.

Total (ug) = XAD-2 (ug) + condensate (ug) + rinses (ug) + impinger (ug) (10)

3) Divide the total ug found by the volume of stack gas sampled (m^3).

(Total ug)/(train sample volume) = concentration of POHC (ug/m^3) (11)

11.0 QUALITY CONTROL

11.1 Sampling: See EPA Manual 600/4-77-027b for Method 5 quality control.

11.2 Analysis: The quality assurance program required for this study includes the analysis of field and method blanks, procedure validations, incorporation of stable labeled surrogate compounds, quantitation versus stable labeled internal standards, capillary column performance checks, and external performance tests. The surrogate spiking compounds selected for a particular analysis are used as primary indicators of the quality of the analytical data for a wide range of compounds and a variety of sample matrices. The assessment of combustion data, positive identification, and quantitation of the selected compounds are dependent on the integrity of the samples received and the precision and accuracy of the analytical methods employed. The quality assurance procedures for this method are designed to monitor the performance of the analytical method and to provide the required information to take corrective action if problems are observed in laboratory operations or in field sampling activities.

11.2.1 Field Blanks: Field blanks must be submitted with the samples collected at each sampling site. The field blanks include the sample bottles containing aliquots of sample recovery solvents, unused filters, and resin cartridges. At a minimum, one complete sampling train will be assembled in the field staging area, taken to the sampling area, and leak-checked at the beginning and end of the testing (or for the same total number of times as the actual test train). The filter housing and probe of the blank train will be heated during the sample test. The train will be recovered as if it were an actual test sample. No gaseous sample will be passed through the sampling train.

11.2.2 Method blanks: A method blank must be prepared for each set of analytical operations, to evaluate contamination and artifacts that can be derived from glassware, reagents, and sample handling in the laboratory.

11.2.3 Refer to Method 8270 for additional quality control considerations.

12.0 METHOD PERFORMANCE

12.1 Method performance evaluation: Evaluation of analytical procedure for a selected series of compounds must include the sample-preparation procedures and each associated analytical determination. The analytical procedures should be challenged by the test compounds spiked at appropriate levels and carried through the procedures.

12.2 Method detection limit: The overall method detection limits (lower and upper) must be determined on a compound-by-compound basis because different compounds may exhibit different collection, retention, and extraction efficiencies as well as instrumental minimum detection limit (MDL). The method detection limit must be quoted relative to a given sample volume. The upper limits for the method must be determined relative to compound retention volumes (breakthrough).

12.3 Method precision and bias: The overall method precision and bias must be determined on a compound-by-compound basis at a given concentration level. The method precision value would include a combined variability due to sampling, sample preparation, and instrumental analysis. The method bias would be dependent upon the collection, retention, and extraction efficiency of the train components. From evaluation studies to date using a dynamic spiking system, method biases of -13% and -16% have been determined for toluene and 1,1,2,2-tetrachloroethane, respectively. A precision of 19.9% was calculated from a field test data set representing seven degrees of freedom which resulted from a series of paired, unspiked Semivolatile Organic Sampling trains (Semi-VOST) sampling emissions from a hazardous waste incinerator.

13.0 REFERENCES

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METHOD 0010, APPENDIX A

PREPARATION OF XAD-2 SORBENT RESIN

1.0 SCOPE AND APPLICATION

1.1 XAD-2 resin as supplied by the manufacturer is impregnated with a bicarbonate solution to inhibit microbial growth during storage. Both the salt solution and any residual extractable monomer and polymer species must be removed before use. The resin is prepared by a series of water and organic extractions, followed by careful drying.

2.0 EXTRACTION

2.1 Method 1: The procedure may be carried out in a giant Soxhlet extractor. An all-glass thimble containing an extra-coarse frit is used for extraction of XAD-2. The frit is recessed 10-15 mm above a crenellated ring at the bottom of the thimble to facilitate drainage. The resin must be carefully retained in the extractor cup with a glass-wool plug and stainless steel screen because it floats on methylene chloride. This process involves sequential extraction in the following order.

Solvent	Procedure
Water	Initial rinse: Place resin in a beaker, rinse once with Type II water, and discard. Fill with water a second time, let stand overnight, and discard.
Water	Extract with H_2O for 8 hr.
Methyl alcohol	Extract for 22 hr.
Methylene chloride	Extract for 22 hr.
Methylene chloride (fresh)	Extract for 22 hr.

2.2 Method 2:

2.2.1 As an alternative to Soxhlet extraction, a continuous extractor has been fabricated for the extraction sequence. This extractor has been found to be acceptable. The particular canister used for the apparatus shown in Figure A-1 contains about 500 g of finished XAD-2. Any size may be constructed; the choice is dependent on the needs of the sampling programs. The XAD-2 is held under light spring tension between a pair of coarse and fine screens. Spacers under the bottom screen allow for even distribution of clean solvent. The three-necked flask should be of sufficient size (3-liter in this case) to hold solvent

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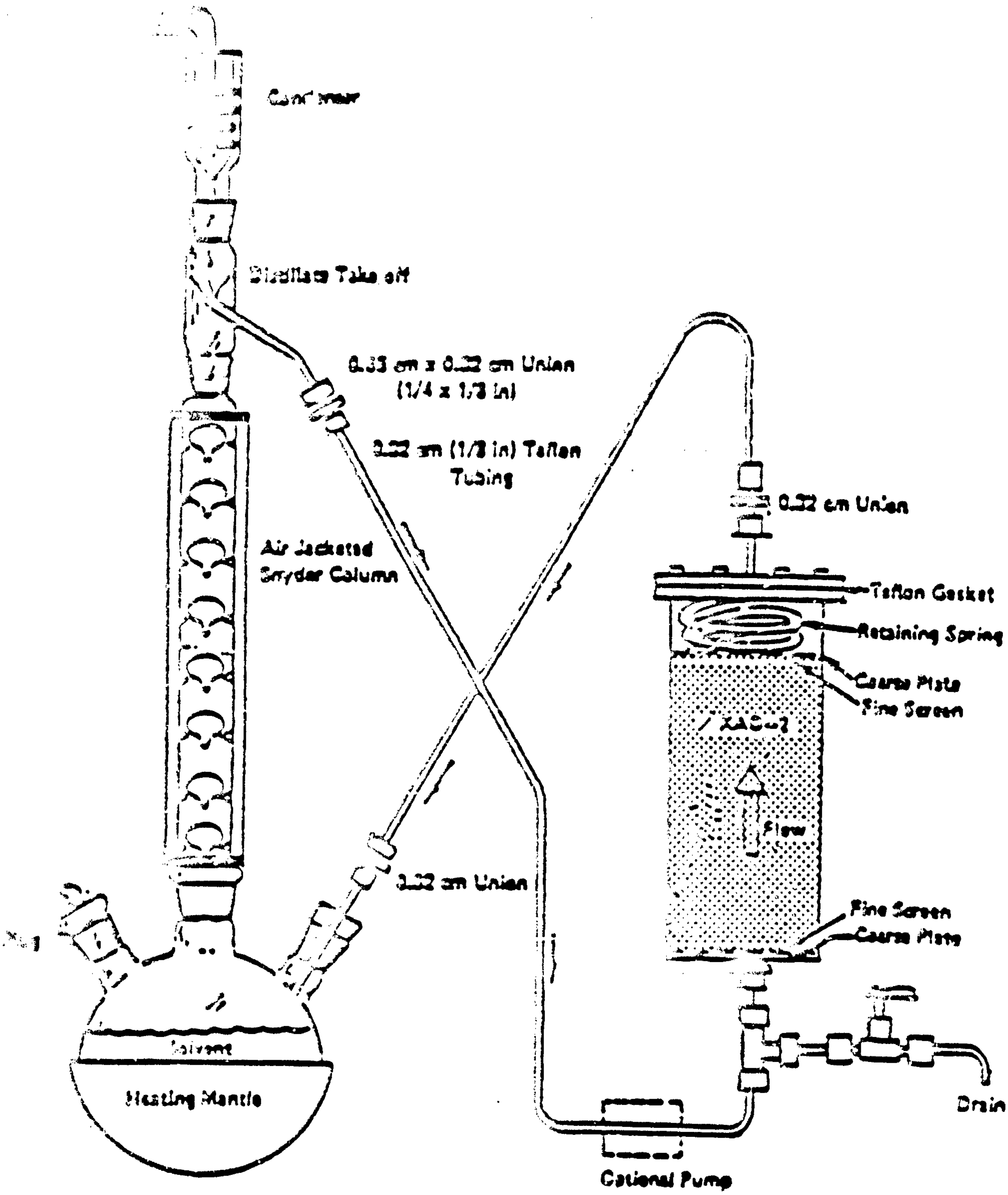

Figure A-1. XAD-2 cleanup extraction apparatus.

equal to twice the dead volume of the XAD-2 canister. Solvent is refluxed through the Snyder column, and the distillate is continuously cycled up through the XAD-2 for extraction and returned to the flask. The flow is maintained upward through the XAD-2 to allow maximum solvent contact and prevent channeling. A valve at the bottom of the canister allows removal of solvent from the canister between changes.

2.2.2 Experience has shown that it is very difficult to cycle sufficient water in this mode. Therefore the aqueous rinse is accomplisned by simply flushing the canister with about 20 liters of distilled water. A small pump may be useful for pumping the water through the canister. The water extraction should be carried out at the rate of about 20-40 mL/min.

2.2.3 After draining the water, subsequent methyl alcohol and methylene chloride extractions are carried out using the refluxing apparatus. An overnight or 10- to 20-hr period is normally sufficient for each extraction.

2.2.4 All materials of construction are glass, Teflon, or stainless steel. Pumps, if used, should not contain extractable materials. Pumps are not used with methanol and methylene chloride.

3.0 DRYING

3.1 After evaluation of several methods of removing residual solvent, a fluidized-bed technique has proved to be the fastest and most reliable drying method.

3.2 A simple column with suitable retainers, as shown in Figure A-2, will serve as a satisfactory column. A 10.2-cm (4-in.) Pyrex pipe 0.6 m (2 ft) long will hold all of the XAD-2 from the extractor shown in Figure A-1 or the Soxhlet extractor, with sufficient space for fluidizing the bed while generating a minimum resin load at the exit of the column.

3.3 Method 1: The gas used to remove the solvent is the key to preserving the cleanliness of the XAD-2. Liquid nitrogen from a standard commercial liquid nitrogen cylinder has routinely proved to be a reliable source of large volumes of gas free from organic contaminants. The liquid nitrogen cylinder is connected to the column by a length of precleaned 0.95-cm (3/8-in.) copper tubing, coiled to pass through a heat source. As nitrogen is bled from the cylinder, it is vaporized in the heat source and passes through the column. A convenient heat source is a water bath heated from a steam line. The final nitrogen temperature should only be warm to the touch and not over 40°C. Experience has shown that about 500 g of XAD-2 may be dried overnight by consuming a full 160-liter cylinder of liquid nitrogen.

3.4 Method 2: As a second choice, high-purity tank nitrogen may be used to dry the XAD-2. The high-purity nitrogen must first be passed through a bed

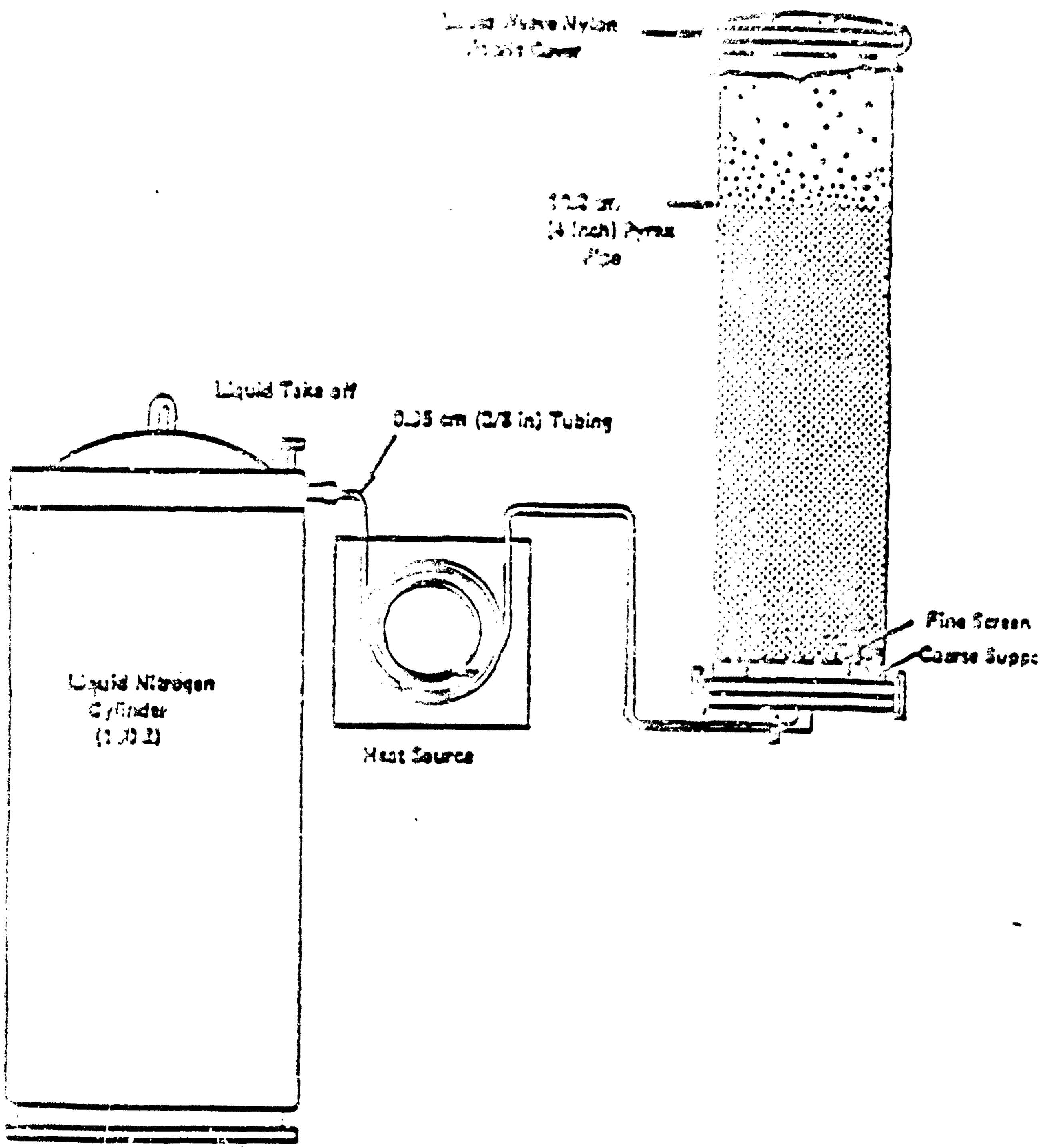

Figure A-2. XAD-2 fluidized-bed drying apparatus.

of activated charcoal approximately 150 mL in volume. With either type of drying method, the rate of flow should gently agitate the bed. Excessive fluidization may cause the particles to break up.

4.0 QUALITY CONTROL PROCEDURES

4.1 For both Methods 1 and 2, the quality control results must be reported for the batch. The batch must be reextracted if the residual extractable organics are >20 ug/mL by TCO analysis or the gravimetric residue is >0.5 mg/20 g XAD-2 extracted. (See also section 5.1, Method 0010.)

4.2 Four control procedures are used with the final XAD-2 to check for (1) residual methylene chloride, (2) extractable organics (TCO), (3) specific compounds of interest as determined by GC/MS, as described in Section 4.5 below, and (4) residue (GRAV).

4.3 Procedure for residual methylene chloride:

4.3.1 Description: A 1±0.1-g sample of dried resin is weighed into a small vial, 3 mL of toluene are added, and the vial is capped and well shaken. Five uL of toluene (now containing extracted methylene chloride) are injected into a gas chromatograph, and the resulting integrated area is compared with a reference standard. The reference solution consists of 2.5 uL of methylene chloride in 100 mL of toluene, simulating 100 ug of residual methylene chloride on the resin. The acceptable maximum content is 1,000 ug/g resin.

4.3.2 Experimental: The gas chromatograph conditions are as follows:

6-ft x 1/8-in. stainless steel column containing 10% OV-101 on 100/120 Supelcoport;

Helium carrier at 30 mL/min;

FID operated on 4 x 10^{-11} A/mV;

Injection port temperature: 250°C;

Detector temperature: 305°C;

Program: 30°C(4 min) 40°C/min 250°C (hold); and

Program terminated at 1,000 sec.

4.4 Procedure for residual extractable organics:

4.4.1 Description: A 20±0.1-g sample of cleaned, dried resin is weighed into a precleaned alundum or cellulose thimble which is plugged with cleaned glass wool. (Note that 20 g of resin will fill a thimble, and the

resin will float out unless well plugged.) The thimble containing the resin is extracted for 24 hr with 200-mL of pesticide- grade methylene chloride (Burdick and Jackson pesticide-grade or equivalent purity). The 200-mL extract is reduced in volume to 10-mL using a Kuderna-Danish concentrator and/or a nitrogen evaporation stream. Five uL of that solution are analyzed by gas chromatography using the TCO analysis procedure. The concentrated solution should not contain >20 ug/mL of TCO extracted from the XAD-2. This is equivalent to 10 ug/g of TCO in the XAD-2 and would correspond to 1.3 mg of TCO in the extract of the 130-g XAD-2 module. Care should be taken to correct the TCO data for a solvent blank prepared (200 mL reduced to 10 mL) in a similar manner.

4.4.2 Experimental: Use the TCO analysis conditions described in the revised Level 1 manual (EPA 600/7-78-201).

4.5 GC/MS Screen: The extract, as prepared in paragraph 4.4.1, is subjected to GC/MS analysis for each of the individual compounds of interest. The GC/MS procedure is described in Chapter Four, Method 8270. The extract is screened at the MDL of each compound. The presence of any compound at a concentration >25 ug/mL in the concentrated extract will require the XAD-2 to be recleaned by repeating the methylene chloride step.

4.6 Methodology for residual gravimetric determination: After the TCO value and GC/MS data are obtained for the resin batch by the above procedures, dry the remainder of the extract in a tared vessel. There must be <0.5 mg residue registered or the batch of resin will have to be extracted with fresh methylene chloride again until it meets this criterion. This level corresponds to 25 ug/g in the XAD-2, or about 3.25 mg in a resin charge of 130 g.

METHOD 0010, APPENDIX B

TOTAL CHROMATOGRAPHABLE ORGANIC MATERIAL ANALYSIS

1.0 SCOPE AND APPLICATION

1.1 In this procedure, gas chromatography is used to determine the quantity of lower boiling hydrocarbons (boiling points between 90° and 300°C) in the concentrates of all organic solvent rinses, XAD-2 resin and LC fractions - when Method 1 is used (see References, Method 0010) - encountered in Level 1 environmental sample analyses. Data obtained using this procedure serve a twofold purpose. First, the total quantity of the lower boiling hydrocarbons in the sample is determined. Then whenever the hydrocarbon concentrations in the original concentrates exceed 75 ug/m^3, the chromatography results are reexamined to determine the amounts of individual species.

The extent of compound identification is limited to representing all materials as normal alkanes based upon comparison of boiling points. Thus the method is not qualitative. In a similar manner, the analysis is semiquantitative; calibrations are prepared using only one hydrocarbon. They are replicated but samples routinely are not.

1.2 Application: This procedure applies solely to the Level 1 C7-C16 gas chromatographic analysis of concentrates of organic extracts, neat liquids, and of LC fractions. Throughout the procedure, it is assumed the analyst has been given a properly prepared sample.

1.3 Sensitivity: The sensitivity of this procedure, defined as the slope of a plot of response versus concentration, is dependent on the instrument and must be verified regularly. TRW experience indicates the nominal range is of the order of 77 uV·V·sec·uL/ng of n-heptane and 79 uV·sec·ul/ng of n-hexadecane. The instrument is capable of perhaps one hundredfold greater sensitivity. The level specified here is sufficient for Level 1 analysis.

1.4 Detection limit: The detection limit of this procedure as written is 1.3 ng/uL for a 1 uL injection of n-decane. This limit is arbitrarily based on defining the minimum detectable response as 100 uv·sec. This is an easier operational definition than defining the minimum detection limit to be that amount of material which yields a signal twice the noise level.

1.5 Range: The range of the procedure will be concentrations of 1.3 ng/uL and greater.

1.6 Limitations

1.6.1 Reporting limitations: It should be noted that a typical environmental sample will contain compounds which: (a) will not elute in the specified boiling ranges and thus will not be reported, and/or (b)

will not elute from the column at all and thus will not be reported. Consequently, the organic content of the sample as reported is a lower bound and should be regarded as such.

1.6.2 **Calibration limitations:** Quantitation is based on calibration with n-decane. Data should therefore be reported as, e.g., mg C8/m^3 as n-decane. Since response varies linearly with carbon number (over a wide range the assumption may involve a 20% error), it is clear that heptane (C7) detected in a sample and quantitated as decane will be overestimated. Likewise, hexadecane (C16) quantitated as decane will be underestimated. From previous data, it is estimated the error involved is on the order of 6-7%.

1.6.3 **Detection limitations:** The sensitivity of the flame ionization detector varies from compound to compound. However, n-alkanes have a greater response than other classes. Consequently, using an n-alkane as a calibrant and assuming equal responses of all other compounds tends to give low reported values.

2.0 SUMMARY OF METHOD

2.1 A mL aliquot of all 10-mL concentrates is disbursed for GC-TCO analysis. With boiling point-retention time and response-amount calibration curves, the data (peak retention times and peak areas) are interpreted by first summing peak areas in the ranges obtained from the boiling point-retention time calibration. Then, with the response-amount calibration curve, the area sums are converted to amounts of material in the reported boiling point ranges.

2.2 After the instrument is set up, the boiling point-retention time calibration is effected by injecting a mixture of n-C7 through n-C16 hydrocarbons and operating the standard temperature program. Response-quantity calibrations are accomplished by injecting n-decane in n-pentane standards and performing the standard temperature program.

2.3 Definitions

2.3.1 GC: Gas chromatography or gas chromatograph.

2.3.2 C7-C16 n-alkanes: Heptane through hexadecane.

2.3.3 GCA temperature program: 4 min isothermal at 60°C, 10°C/min from 60° to 220°C.

2.3.4 TRW temperature program: 5 min isothermal at room temperature, then program from 30°C to 250°C at 15°C/min.

3.0 INTERFERENCES

Not applicable.

4.0 APPARATUS AND MATERIALS

4.1 Gas chromatograph: This procedure is intended for use on a Varian 1360 gas chromatograph, equipped with dual flame ionization detectors and a linear temperature programmer. Any equivalent instrument can be used provided that electrometer settings, etc., be changed appropriately.

4.2 Gases:

4.2.1 Helium: Minimum quality is reactor grade. A 4A or 13X molecular sieve drying tube is required. A filter must be placed between the trap and the instrument. The trap should be recharged after every third tank of helium.

4.2.2 Air: Zero grade is satisfactory.

4.2.3 Hydrogen: Zero grade.

4.3 Syringe: Syringes are Hamilton 701N, 10 uL, or equivalent.

4.4 Septa: Septa will be of such quality as to produce very low bleed during the temperature program. An appropriate septum is Supelco Microsep 138, which is Teflon-backed. If septum bleed cannot be reduced to a negligible level, it will be necessary to install septum swingers on the instrument.

4.5 Recorder: The recorder of this procedure must be capable of not less than 1 mV full-scale display, a 1-sec time constant and 0.5 in. per min chart rate.

4.6 Integrator: An integrator is required. Peak area measurement by hand is satisfactory but too time-consuming. If manual integration is required, the method of "height times width at half height" is used.

4.7 Columns:

4.7.1 Preferred column: 6 ft x 1/8 in. O.D. stainless steel column of 10% OV-101 on 100/120 mesh Supelcoport.

4.7.2 Alternate column: 6 ft x 1/8 in. O.D. stainless steel column of 10% OV-1 (or other silicon phase) on 100/120 mesh Supelcoport.

4.8 Syringe cleaner: Hamilton syringe cleaner or equivalent connected to a suitable vacuum source.

5.0 REAGENTS

5.1 Pentane: "Distilled-in-Glass" (reg. trademark) or "Nanograde" (reg. trademark) for standards and for syringe cleaning.

5.2 Methylene chloride: "Distilled-in-Glass" (reg. trademark) or "Nanograde" (reg. trademark) for syringe cleaning.

6.0 SAMPLING HANDLING AND PRESERVATION

6.1 The extracts are concentrated in a Kuderna-Danish evaporator to a volume less than 10 mL. The concentrate is then quantitatively transferred to a 10-mL volumetric flask and diluted to volume. A 1-mL aliquot is taken for both this analysis and possible subsequent GC/MS analysis and set aside in the sample bank. For each GC-TCO analysis, obtain the sample sufficiently in advance to allow it to warm to room temperature. For example, after one analysis is started, return that sample to the sample bank and take the next sample.

7.0 PROCEDURES

7.1 Setup and checkout: Each day, the operator will verify the following:

7.1.1 That supplies of carrier gas, air and hydrogen are sufficient, i.e., that each tank contains > 100 psig.

7.1.2 That, after replacement of any gas cylinder, all connections leading to the chromatograph have been leak-checked.

7.1.3 That the carrier gas flow rate is 30 $\pm$ 2 mL/min, the hydrogen flow rate is 30 $\pm$ 2 mL/min, and the air flow rate is 300 $\pm$ 20 mL/min.

7.1.4 That the electrometer is functioning properly.

7.1.5 That the recorder and integrator are functioning properly.

7.1.6 That the septa have been leak-checked (leak-checking is effected by placing the soap bubble flow meter inlet tube over the injection port adaptors), and that no septum will be used for more than 20 injections.

7.1.7 That the list of samples to be run is ready.

7.2 Retention time calibration:

7.2.1 To obtain the temperature ranges for reporting the results of the analyses, the chromatograph is given a normal boiling point-retention time calibration. The n-alkanes, their boiling points, and data reporting ranges are given in the table below:

	NBP,°C	Reporting Range,°C	Report As
n-heptane	98	90-110	C7
n-octane	126	110-140	C8
n-nonane	151	140-160	C9
n-decane	174	160-180	C10
n-undecane	194	180-200	C11
n-dodecane	214	200-220	C12
n-tridecane	234	220-240	C13
n-tetradecane	252	240-260	C14
n-pentadecane	270	260-280	C15
n-hexadecane	288	280-300	C16

7.2.2 **Preparation of standards:** Preparing a mixture of the C7-C16 alkanes is required. There are two approaches: (1) use of a standards kit (e.g., Polyscience Kit) containing bottles of mixtures of selected n-alkanes which may be combined to produce a C7-C16 standard; or (2) use of bottles of the individual C7-C16 alkanes from which accurately known volumes may be taken and combined to give a C7-C16 mixture.

7.2.3 **Procedure for retention time calibration:** This calibration is performed at the start of an analytical program; the mixture is chromatographed at the start of each day. To attain the required retention time precision, both the carrier gas flow rate and the temperature program specifications must be observed. Details of the procedure depend on the instrument being used. The general procedure is as follows:

7.2.3.1 Set the programmer upper limit at 250°C. If this setting does not produce a column temperature of 250°C, find the correct setting.

7.2.3.2 Set the programmer lower limit at 30°C.

7.2.3.3 Verify that the instrument and samples are at room temperature.

7.2.3.4 Inject 1 uL of the n-alkane mixture.

7.2.3.5 Start the integrator and recorder.

7.2.3.6 Allow the instrument to run isothermally at room temperature for five min.

7.2.3.7 Shut the oven door.

7.2.3.8 Change the mode to Automatic and start the temperature program.

7.2.3.9 Repeat Steps 1-9 a sufficient number of times so that the relative standard deviation of the retention times for each peak is <5%.

7.3 Response calibration:

7.3.1 For the purposes of a Level 1 analysis, response-quantity calibration with n-decane is adequate. A 10-uL volume of n-decane is injected into a tared 10 mL volumetric flask. The weight injected is obtained and the flask is diluted to the mark with n-pentane. This standard contains about 730 ng n-decane per uL n-pentane. The exact concentration depends on temperature, so that a weight is required. Two serial tenfold dilutions are made from this standard, giving standards at about 730, 73, and 7.3 ng n-decane per uL n-pentane, respectively.

7.3.2 Procedure for response calibration: This calibration is performed at the start of an analytical program and monthly thereafter. The most concentrated standard is injected once each day. Any change in calibration necessitates a full calibration with new standards. Standards are stored in the refrigerator locker and are made up monthly.

7.3.2.1 Verify that the instrument is set up properly.

7.3.2.2 Set electrometer at 1×10^{-10} A/mV.

7.3.2.3 Inject 1 uL of the highest concentration standard.

7.3.2.4 Run standard temperature program as specified above.

7.3.2.5 Clean syringe.

7.3.2.6 Make repeated injections of all three standards until the relative standard deviations of the areas of each standard are $\leq$5%.

7.4 Sample analysis procedure:

7.4.1 The following apparatus is required:

7.4.1.1 Gas chromatograph set up and working.

7.4.1.2 Recorder, integrator working.

7.4.1.3 Syringe and syringe cleaning apparatus.

7.4.1.4 Parameters: Electrometer setting is 1×10^{-10} A/mV; recorder is set at 0.5 in./min and 1 mV full-scale.

7.4.2 Steps in the procedure are:

7.4.2.1 Label chromatogram with the data, sample number, etc.

7.4.2.2 Inject sample.

7.4.2.3 Start integrator and recorder.

7.4.2.4 After isothermal operation for 5 min, begin temperature program.

7.4.2.5 Clean syringe.

7.4.2.6 Return sample; obtain new sample.

7.4.2.7 When analysis is finished, allow instrument to cool. Turn chromatogram and integrator output and data sheet over to data analyst.

7.5 Syringe cleaning procedure:

7.5.1 Remove plunger from syringe.

7.5.2 Insert syringe into cleaner; turn on aspirator.

7.5.3 Fill pipet with pentane; run pentane through syringe.

7.5.4 Repeat with methylene chloride from a separate pipet.

7.5.5 Flush plunger with pentane followed by methylene chloride.

7.5.6 Repeat with methylene chloride.

7.6 Sample analysis decision criterion: The data from the TCO analyses of organic extract and rinse concentrates are first used to calculate the total concentration of C7-C16 hydrocarbon-equivalents (Paragraph 7.7.3) in the sample with respect to the volume of air actually sampled, i.e., ug/m^3. On this basis, a decision is made both on whether to calculate the quantity of each n-alkane equivalent present and on which analytical procedural pathway will be followed. If the total organic content is great enough to warrant continuing the analysis -- $>$500 ug/m^3 -- a TCO of less than 75 ug/m^3 will require only LC fractionation and gravimetric determinations and IR spectra to be obtained on each fraction. If the TCO is greater than 75 ug/m^3, then the first seven LC fractions of each sample will be reanalyzed using this same gas chromatographic technique.

7.7 Calculations:

7.7.1 Boiling Point - Retention Time Calibration: The required data for this calibration are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.1.1 Average the retention times and calculate relative standard deviations for each n-hydrocarbon.

7.7.1.2 Plot average retention times as abscissae versus normal boiling points as ordinates.

7.7.1.3 Draw in calibration curve.

7.7.1.4 Locate and record retention times corresponding to boiling ranges 90-100, 110-140, 140-160, 160-180, 180-200, 200-220, 220-240, 240-260, 260-280, 280-300°C.

7.7.2 Response-amount calibration: The required data for this calibration are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.2.1 Average the area responses of each standard and calculate relative standard deviations.

7.7.2.2 Plot response (uv·sec) as ordinate versus ng/uL as abscissa.

7.7.2.3 Draw in the curve. Perform least squares regression and obtain slope (uV·sec·uL/ng).

7.7.3 Total C7-C16 hydrocarbons analysis: The required data for this calculation are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.3.1 Sum the areas of all peaks within the retention time range of interest.

7.7.3.2 Convert this area (uV·sec) to ng/uL by dividing by the weight response for n-decane (uV·sec.uL/ng).

7.7.3.3 Multiply this weight by the total concentrate volume (10 mL) to get the weight of the C7-C16 hydrocarbons in the sample.

7.7.3.4 Using the volume of gas sampled or the total weight of sample acquired, convert the result of Step 7.7.3.3 above to ug/m^3.

7.7.3.5 If the value of total C7-C16 hydrocarbons from Step 7.7.3.4 above exceeds 75 ug/m^3, calculate individual hydrocarbon concentrations in accordance with the instructions in Paragraph 7.7.5.5 below.

7.7.4 Individual C7-C16 n-Alkane Equivalent Analysis: The required data from the analyses are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.4.1 Sum the areas of peaks in the proper retention time ranges.

7.7.4.2 Convert areas (uV·sec) to ng/uL by dividing by the proper weight response (uV·sec·uL/ng).

7.7.4.3 Multiply each weight by total concentrate volume (10 mL) to get weight of species in each range of the sample.

7.7.4.4 Using the volume of gas sampled on the total weight of sample acquired, convert the result of Step 7.7.4.3 above to ug/m^3.

8.0 QUALITY CONTROL

8.1 Appropriate QC is found in the pertinent procedures throughout the method.

9.0 METHOD PERFORMANCE

9.1 Even relatively comprehensive error propagation analysis is beyond the scope of this procedure. With reasonable care, peak area reproducibility of a standard should be of the order of 1% RSD. The relative standard deviation of the sum of all peaks in a fairly complex waste might be of the order of 5-10%. Accuracy is more difficult to assess. With good analytical technique, accuracy and precision should be of the order of 10-20%.

10.0 REFERENCES

1. Emissions Assessment of Conventional Stationary Combustion Systems: Methods and Procedure Manual for Sampling and Analysis, Interagency Energy/Environmental R&D Program, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711, EPA-600/7-79-029a, January 1979.

EPA METHOD 5

DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

METHOD 5—DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120±14° C (248±25° F) or such other temperature as specified by an applicable subpart of the standards or approved by Administrator, U.S. Environmental Protection Agency, for a particular application. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources.

2. *Apparatus*

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTD-0581 (Citation 2 in Bibliography); commercial models of this train are also available. For changes from APTD-0581 and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576 (Citation 3 in Bibliography). Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The sampling train consists of the following components:

2.1.1 Probe Nozzle. Stainless steel (316) or glass with sharp, tapered leading edge. The angle of taper shall be <30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tubing; other materials of construction may be used, subject to the approval of the Administrator.

A range of nozzle sizes suitable for isokinetic sampling should be available, e.g., 0.32 to 1.27 cm (⅛ to ½ in.)—or larger if higher volume sampling trains are used—inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in Section 5.

2.1.2 Probe Liner. Borosilicate or quartz glass tubing with a heating system capable of maintaining a gas temperature at the exit end during sampling of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. (The tester may opt to operate the equipment at a temperature lower than that specified.) Since the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable.

Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480° C (900° F); quartz liners shall be used for temperatures between 480 and 900° C (900 and 1,650° F). Both types of liners may be used at higher temperatures than specified for short periods of time, subject to the approval of the Administrator. The softening temperature for borosilicate is 820° C (1,508° F), and for quartz it is 1,500° C (2,732° F).

Whenever practical, every effort should be made to use borosilicate or quartz glass probe liners. Alternatively, metal liners (e.g., 316 stainless steel, Incoloy 825,[1] or other corrosion resistant metals) made of seamless tubing may be used, subject to the approval of the Administrator.

2.1.3 Pitot Tube. Type S, as described in Section 2.1 of Method 2, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1) to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of Method 2.

[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

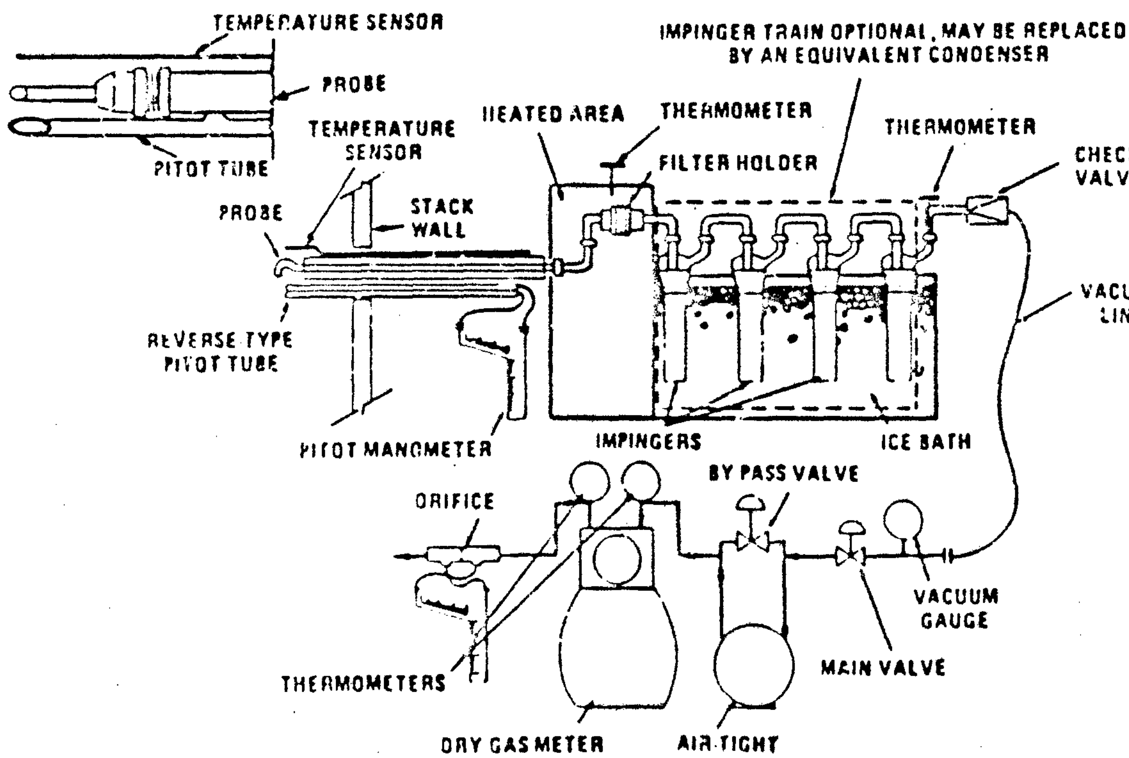

Figure 5-1. Particulate sampling train.

2.1.4 Differential Pressure Gauge. Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used for velocity head (Δp) readings, and the other, for orifice differential pressure readings.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

2.1.6 Filter Heating System. Any heating system capable of maintaining a temperature around the filter holder during sampling of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3° C (5.4° F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

2.1.7 Condenser. The following system shall be used to determine the stack gas moisture content: Four impingers connected in series with leak-free ground glass fittings or any similar leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with 1.3 cm (½ in.) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator. The first and second impingers shall contain known quantities of water (Section 4.1.3), the third shall be empty, and the fourth shall contain a known weight of silica gel, or equivalent desiccant. A thermometer, capable of measuring temperature to within 1° C (2° F) shall be placed at the outlet of the fourth impinger for monitoring purposes.

Alternatively, any system that cools the sample gas stream and allows measurement of the water condensed and moisture leaving the condenser, each to within 1 ml or 1 g may be used, subject to the approval of the Administrator. Acceptable means are to measure the condensed water either gravimetrically or volumetrically and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures; or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap with exit gases kept below 20° C (68° F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

NOTE: If a determination of the particulate matter collected in the impingers is desired in addition to moisture content, the impinger system described above shall be used, without modification. Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impinger contents.

2.1.3 Metering System. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that decribed in APTD-0581 or APDT-0576 may be used provided that the specifications of this method are met.

2.1.9 Barometer. Mercury aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.10 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-7). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

2.2 Sample Recovery. The following items are needed.

2.2.1 Probe-Liner and Probe-Nozzle Brushes. Nylon bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) of stainless steel, Nylon, Teflon, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

2.2.2 Wash Bottles—Two. Glass wash bottles are recommended; polyethylene wash bottles may be used at the option of the tester. It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 Glass Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1000 ml. Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemical attack by acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 Petri Dishes. For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated Cylinder and/or Balance. To measure condensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable or use here and in Section 2.3.4.

2.2.6 Plastic Storage Containers. Air-tight containers to store silica gel.

2.2.7 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not

2.2.8 Funnel. Glass or polyethylene, to aid in sample recovery.

2.2 Analysis. For analysis, the following equipment is needed.

2.3.1 Glass Weighing Dishes.

2.3.2 Desiccator.

2.3.3 Analytical Balance. To measure to within 0.1 mg.

2.3.4 Balance. To measure to within 0.5 g.

2.3.5 Beakers. 250 ml.

2.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

2.3.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. *Reagents*

3.1 Sampling. The reagents used in sampling are as follows:

3.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (<0.05 percent penetration) on 0.3-micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D2986-71 (Reapproved 1978) (incorporated by reference—see § 60.17). Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO_2 or SO_3, the filter material must be of a type that is unreactive to SO_2 or SO_3. Citation 10 in Section 7 Bibliography, may be used to select the appropriate filter.

3.1.2 Silica Gel. Indicating type, 6 to 16 mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 Water. When analysis of the material caught in the impingers is required, distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

3.1.4 Crushed Ice.

3.1.5 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.3 Post-test Leak-Check. A leak-check is mandatory at the conclusion of each sampling run. The leakcheck shall be done in accordance with the procedures outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

4.1.5 Particulate Train Operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator.

For each run, record the data required on a data sheet such as the one shown in Figure 5-2. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted. Take other readings required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85±0.02, and the stack gas equivalent density (dry molecular weight) is equal to 29±4. APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above stated ranges do not use the nomographs unless appropriate steps (see Citation 7 in Bibliography) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block o[ff] the openings around the probe and portho[le] to prevent unrepresentative dilution of t[he] gas stream.

Traverse the stack cross-section, as r[e]quired by Method 1 or as specified by t[he] Administrator, being careful not to bum[p] the probe nozzle into the stack walls whe[n] sampling near the walls or when removi[ng] or inserting the probe through the por[t]holes; this minimizes the chance of extrac[t]ing deposited material.

During the test run, make periodic adju[st]ments to keep the temperature around th[e] filter holder at the proper level; add mor[e] ice and, if necessary, salt to maintain a tem[]perature of less than 20° C (68° F) at th[e] condenser/silica gel outlet. Also, periodica[l]ly check the level and zero of the manom[e]ter.

If the pressure drop across the filter be[]comes too high, making isokinetic samplin[g] difficult to maintain, the filter may be re[]placed in the midst of a sample run. It i[s] recommended that another complete filte[r] assembly be used rather than attempting t[o] change the filter itself. Before a new filte[r] assembly is installed, conduct a leak-chec[k] (see Section 4.1.4.2). The total particulat[e] weight shall include the summation of a[ll] filter assembly catches.

A single train shall be used for the entir[e] sample run, except in cases where simulta[]neous sampling is required in two or mor[e] separate ducts or at two or more differen[t] locations within the same duct, or, in case[s] where equipment failure necessitates [a] change of trains. In all other situations, th[e] use of two or more trains will be subject t[o] the approval of the Administrator.

FIGURE 5-2—PARTICULATE FIELD DATA

Plant ______
Location ______
Operator ______
Date ______
Run No. ______
Sample box No. ______
Meter box No. ______
Meter $\Delta H@$ ______
C factor ______
Pitot tube coefficient, Cp ______

SCHEMATIC OF STACK CROSS SECTION

Ambient temperature ______
Barometric pressure ______
Assumed moisture, % ______
Probe length, m (ft.) ______
Nozzle identification No. ______
Average calibrated nozzle diameter, cm (in.) ______
Probe heater setting ______
Leak rate, m³/min. (cfm) ______
Probe liner material ______
Static pressure, mm Hg (in. Hg) ______
Filter No. ______

Traverse point number	Sampling time (θ), min.	Vacuum mm Hg (in. Hg)	Stack temperature (T_s) °C (°F)	Velocity head (ΔP_s) mm (in.) H_2O	Pressure differential across orifice meter mm H_2O (in. H_2O)	Gas sample volume m³ (ft³)	Gas sample temperature at dry gas meter: Inlet °C (°F)	Gas sample temperature at dry gas meter: Outlet °C (°F)	Filter holder temperature °C (°F)	Temperature of gas leaving condenser or last impinger °C (°F)
Total							Avg.	Avg.		
Average							Avg.			

3.2 Sample Recovery. Acetone-reagent grade, <0.001 percent residue, in glass bottles—is required. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers; thus, acetone blanks shall be run prior to field use and only acetone with low blank values (<0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analysis. Two reagents are required for the analysis:

3.3.1 Acetone. Same as 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. *Procedure*

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. It is suggested that sampling equipment be maintained according to the procedures described in APTD-0576.

Weigh several 200 to 300 g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in the impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper diameter on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at 20±5.6° C (68±10° F) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., 0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 105° C (220° F) for 2 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2; it is recommended that a leak-check of the pitot lines (see Method 2, Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in Method 2, Section 3.6; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 min (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors. The sampling time at each point shall be the same.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzle using a Viton A O-ring when stack temperatures are less than 260° C (500° F) and an asbestos string gasket when temperatures are higher. See APTD-0576 for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum.

NOTE: A lower vacuum may be used, provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm Hg (15 in. Hg) vacuum (see Note immediately above). Then connect the probe to the train and leak-check at about 25 mm Hg (1 in. Hg) vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm Hg (15 in. Hg) vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Do not reverse direction of bypass value; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check as shown below and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica gel from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes unecessary, a leak-check shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered;

Note that when two or more trains are used, separate analyses of the front-half and (if applicable) impinger catches from each train shall be performed, unless identical nozzle sizes were used on all trains, in which case, the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of front-half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2, Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry Nylon bristle brush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank and follow the Administrator's directions on analysis. Perform the acetone rinses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a Nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid in transferring liquid washes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe; hold a sample container underneath the lower end of the probe, and catch any acetone and particulate matter which is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Rinse the brush with acetone, and quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a Nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether or not leakage occured during transport. Label the container to clearly identify its contents.

Container No. 3. Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows: Make a notation of any color or film in the liquid catch. Measure the liquid which is in the first three impingers to within ±1 ml by using a graduated cylinder or by weighing it to within ±0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Note, Section 2.1.7).

If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet such as the one shown in Figure 5-3. Handle each sample container as follows:

FIGURE 5-3—ANALYTICAL DATA

Plant ____________
Date ____________
Run No. ____________
Filter No. ____________
Amount liquid lost during transport ____________
Acetone blank volume, ml ____________
Acetone wash volume, ml ____________
Acetone blank concentration, mg/mg (equation 5-4) ____________
Acetone wash blank, mg (equation 5-5) ____________

Container number	Weight of particulate collected, mg		
	Final weight	Tare weight	Weight gain
1 ______			
2 ______			
Total ______			
Less acetone blank ______			
Weight of particulate matter ______			

	Volume of liquid water collected	
	Impinger volume, ml	Silica gel weight, g
Final ______		
Initial ______		
Liquid collected ______		
Total volume collected ______		g* ml

*Convert weight of water to volume by dividing total weight increase by density of water (1 g/ml).

$$\frac{\text{Increase, g}}{(1\ \text{g/ml})} = \text{Volume water, ml}$$

Container No. 1. Leave the contents in the shipping container or transfer the filter and any loose particulate from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at 105° C (220° F) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at 105° C (220° F) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

NOTE: At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

4.4 Quality Control Procedures. The following quality control procedures are suggested to check the volume metering system calibration values at the field test site prior to sample collection. These procedures are optional for the tester.

4.4.1 Meter Orifice Check. Using the calibration data obtained during the calibration procedure described in Section 5.3, determine the $\Delta H_@$ for the metering system orifice. The $\Delta H_@$ is the orifice pressure differential in units of in. H_2O that correlates to 0.75 cfm of air at 528°R and 29.92 in. Hg. The $\Delta H_@$ is calculated as follows:

$$\Delta H_@ = 0.0319\ \Delta H\ \frac{T_m}{P_{bar}}\ \frac{\Theta^2}{Y^2 V_m^2}$$

Eq. 5-9

Where:

ΔH = Average pressure differential across the orifice meter, in. H_2O.

T_m = Absolute average dry gas meter temperature, °R.

P_{bar} = Barometric pressure, in. Hg.

Θ = Total sampling time, min.

Y = Dry gas meter calibration factor, dimensionless.

V_m = Volume of gas sample as measured by dry gas meter, dcf.

0.0319 = (0.0567 in. Hg/°R) x (0.75 cfm)²

Before beginning the field test (a set of three runs usually constitutes a field test), operate the metering system (i.e., pump, volume meter, and orifice) at the $\Delta H_@$ pressure differential for 10 minutes. Record the volume collected, the dry gas meter temperature, and the barometric pressure. Calculate a dry gas meter calibration check value, Y_c, as follows:

$$Y_c = \frac{10}{V_m}\left[\frac{0.0319\ T_m}{P_{bar}}\right]^{1/2}$$

Eq. 5-10

Where:

Y_c = Dry gas meter calibration check value, dimensionless.

10 = 10 minutes of run time.

Compare the Y_c value with the dry gas meter calibration factor Y to determine that:

$0.97Y < Y_c < 1.03Y$

If the Y_c value is not within this range, the volume metering system should be investigated before beginning the test.

4.4.2 Calibration Critical Orifice. A calibrated critical orifice, calibrated against a wet test meter or spirometer and designed to be inserted at the inlet of the sampling meter box, may be used as a quality control check by following the procedure of Section 7.2.

5. *Calibration*

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of Method 2.

5.3 Metering System. Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry gas meter dial readings to correspond to the wet test meter readings, calibration factors may be used to mathematically correct the gas meter dial readings to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.0057 m³/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divide the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). With the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

Alternative procedures, e.g., using the orifice meter coefficients, maybe used, subject to the approval of the Administrator.

NOTE: If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.3.1 Calibration Prior to Use. Before its initial use in the field, the metering system shall be calibrated as follows: Connect the metering system inlet to the outlet of a wet test meter that is accurate to within 1 percent. Refer to Figure 5.5. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev). A spirometer of 400 liters (14 ft³) or more capacity, or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should be periodically calibrated with a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained. Run the metering system pump for about 15 minutes with the orifice manometer indicating a median reading as expected in field use to allow the pump to warm up and to permit the interior surface of the wet test meter to be thoroughly wetted. Then, at each of a minimum of three orifice manometer settings, pass an exact quantity of gas through the wet test meter and note the gas volume indicated by the dry gas meter. Also note the barometric pressure, and the temperatures of the wet test meter, the inlet of the dry gas meter, and the outlet of the dry gas meter. Select the highest and lowest orifice settings to bracket the expected field operating range of the orifice. Use a minimum volume of 0.15 m³ (5 cf) at all orifice settings. Record all the data on a form similar to Figure 5.6, and calculate Y, the dry gas meter calibration factor, and ΔH@, the orifice calibration factor, at each orifice setting as shown on Figure 5.6. Allowable tolerances for individual Y and ΔH@ values are given in Figure 5.6. Use the average of the Y values in the calculations in Section 6.

Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057 m³/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divided the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

5.3.2 Calibration After Use. After each filed use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, inset a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the dry gas meter calibration factor. If the value has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as previously detailed.

Alternative procedures, e.g., rechecking the orifice meter coefficient may be used, subject to the approval of the Administrator.

5.3.3 Acceptable Variation in Calibration. If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field.

Use a heat source to generate air heated to selected temperatures that approximate those expected to occur in the sources to be sampled. Pass this air through the probe at a typical sample flow rate while measuring the probe inlet and outlet temperatures at various probe heater settings. For each air temperature generated, construct a graph of probe heating system setting versus probe outlet temperature. The procedure outlined in APTD-0576 can also be used. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used. Also, probes with outlet temperature monitoring capabilities do not require calibration.

5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The follow-

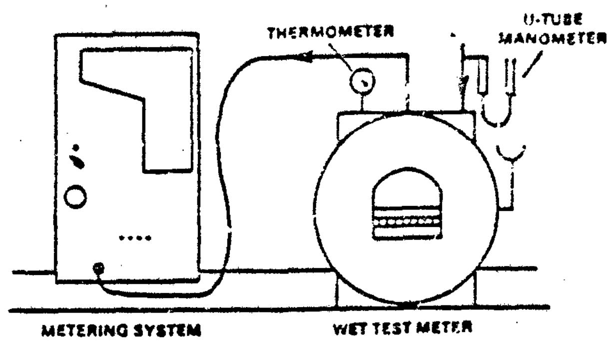

Figure 5.5 Equipment arrangement for metering system calibration.

Date ____________ Metering System Identification: ____________

Barometric pressure, P_b = ______ in. Hg

Orifice manometer setting ΔH in. H_2O	Spirometer (wet meter) gas volume (V_w) ft³	Dry gas meter volume (V_m) ft³	Temperatures: Spirometer (wet meter) (t_w) °F	Temperatures: Dry Gas Meter Inlet (t_i) °F	Temperatures: Dry Gas Meter Outlet (t_o) °F	Temperatures: Dry Gas Meter Average (t_m) °F	Time (θ) min

Calculations

ΔH in. H_2O	Y: $\dfrac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$	$\Delta H_@$: $\dfrac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\dfrac{(t_w + 460)\theta}{V_w}\right]^2$
Average		

Y = Ratio of reading of wet test meter to dry test meter; tolerance for individual values ±0.02 from average.

$\Delta H_@$ = Orifice pressure differential that equates to 0.75 cfm of air @ 68°F and 29.92 inches of mercury, in. H_2O; tolerance for individual values ±0.20 from average.

Figure 5.6. Example data sheet for calibration of metering system (English units).

ing procedure is suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.7 Barometer. Calibrate against a mercury barometer.

6. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

6.1 Nomenclature

A_n = Cross-sectional area of nozzle, m^2 (ft^2).
B_{ws} = Water vapor in the gas stream, proportion by volume.
C_a = Acetone blank residue concentration, mg/mg
c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
I = Percent of isokinetic sampling.
L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.
L_i = Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (i=1, 2, 3....n), m^3/min (cfm).
L_p = Leakage rate observed during the post-test leak check, m^3/min (cfm).
m_n = Total amount of particulate matter collected, mg.
M_w = Molecular weight of water, 18.0 g/g-mole (18.0lb/lb-mole).
m_a = Mass of residue of acetone after evaporation, mg.
P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).
P_s = Absolute stack gas pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R = Ideal gas constant, 0.06236 mm Hg-m^3/°K-g-mole (21.85 in. Hg-ft^3/°R-lb-mole).
T_m = Absolute average dry gas meter temperature (see Figure 5-2), °K (°R).
T_s = Absolute average stack gas temperature (see Figure 5-2), °K (°R).
T_{std} = Standard absolute temperature, 293° (528° R).
V_a = Volume of acetone blank, ml.
V_{aw} = Volume of acetone used in wash, ml.
V_{lc} = Total volume of liquid collected in impingers and silica gel (see Figure 5- ml.
V_m = Volume of gas sample as measured dry gas meter, dcm (dscf).
$V_{m(std)}$ = Volume of gas sample measured the dry gas meter, corrected to standa conditions, dscm (dscf).
$V_{w(std)}$ = Volume of water vapor in the g sample, corrected to standard conc tions, scm (scf).
v_s = Stack gas velocity, calculated by Methc 2, Equation 2-9, using data obtain from Method 5, m/sec (ft/sec).
W_a = Weight of residue in acetone wash, m
Y = Dry gas meter calibration factor.
ΔH = Average pressure differential acro the orifice meter (see Figure 5-2), m H_2O (in. H_2O).
ρ_a = Density of acetone, mg/ml (see label c bottle).

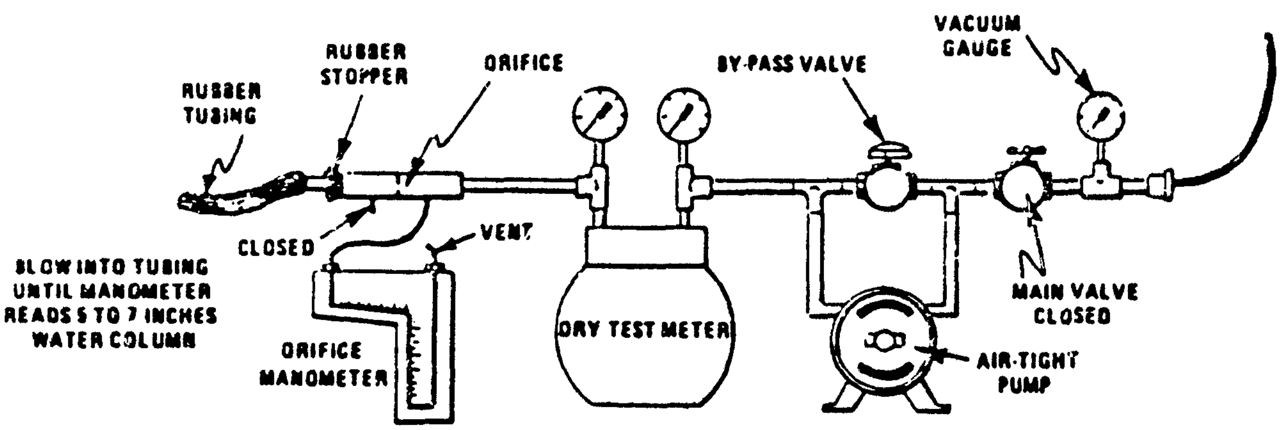

Figure 5-4. Leak check of meter box.

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

θ = Total sampling time, min.

θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.

θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C; 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right]$$

$$= K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m}$$

Equation 5-1

where:

K_1 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

NOTE: Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 5-1 must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 5-1 with the expression:

$$[V_m - (L_p - L_a)\theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-1 by the expression:

$$\left[V_m - (L_1 - L_a)\theta_1 - \sum_{i=2}^{n} (L_i - L_a)\theta_i - (L_p - L_a)\theta_p\right]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

6.4 Volume of water vapor.

Equation 5-2

$$V_{w(std)} = V_{1c}\left(\frac{\rho_w}{M_w}\right)\left(\frac{RT_{std}}{P_{std}}\right) = K_2 V_{1c}$$

where:

K_2 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units.

6.5 Moisture Content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$

Equation 5-3

NOTE: In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of B_w shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1° C (2° F).

6.6 Acetone Blank Concentration.

Equation 5-4

$$C_a = \frac{m_a}{V_a \rho_a}$$

6.7 Acetone Wash Blank.

$W_a = C_a V_{aw} \rho_a$ Equation 5-5

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from containers 1 and 2 less the acetone blank (see Figure 5-3).

NOTE: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

c_s = (0.001 g/mg) (m_n/$V_{m(std)}$) Equation 5-6

6.10 Conversion Factors:

From	To	Multiply by
scf	m³	0.02832
g/ft³	gr/ft³	15.43
g/ft³	lb/ft³	2.205 × 10⁻³
g/ft³	g/m³	35.31
g	mg	0.001

6.11 Isokinetic Varition.

6.11.1 Calculation From Raw Data.

$$I = \frac{100\, T_s [K_3 V_{1c} + (V_m Y/T_m)(P_{bar} + \Delta H/13.6)]}{60 \theta v_s P_s A_n}$$

Equation 5-7

where:

K_3 = 0.003454 mm Hg-m³/ml-°K for metric units.
= 0.002669 in. Hg-ft³/ml-°R for English units.

6.11.2 Calculation From Intermediate Values.

$$I = \frac{T_s V_{m(std)} P_{std} 100}{T_{std} v_s \theta A_n P_s 60 (1-B_{ws})}$$

$$= K_4 \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1-B_{ws})}$$

Equation 5-8

where:

K_4 = 4.320 for metric units
= 0.09450 for English units.

6.12 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the particulate results are low in comparison to the standard, and I is over 110 percent or less than 90 percent, the Administrator may accept the results. Citation 4 in the bibliography section can be used to make acceptability judgments. If I is judeged to be unacceptable, reject the particulate results and repeat the test.

6.13 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in Sections 5.2 and 5.3 of Method 2.

7. *Alternative Procedures*

7.1 Dry Gas Meter as a Calibration Standard. A dry gas meter may be used as a calibration standard for volume measurements in place of the wet test meter specified in Section 5.3, provided that it is calibrated initially and recalibrated periodically as follows:

7.1.1 *Standard Dry Gas Meter Calibration.*

7.1.1.1 The dry gas meter to be calibrated and used as a secondary reference meter should be of high quality and have an appropriately sized capacity, e.g., 3 liters/rev (0.1 ft³/rev). A spirometer (400 liters or more capacity), or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev) and capable of measuring volume to within ±1.0 percent; wet test meters should be checked against a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

7.1.1.2 Set up the components as shown in Figure 5.7. A spirometer, or equivalent, may be used in place of the wet test meter in the system. Run the pump for at least 5 minutes at a flow rate of about 10 liters/min (0.35 cfm) to condition the interior surface of the wet test meter. The pressure drop indicated by the manometer at the inlet side of the dry gas meter should be minimized [no greater than 100 mm H_2O (4 in. H_2O) at a flow rate of 30 liters/min (1 cfm)]. This can be accomplished by using large diameter tubing connections and straight pipe fittings.

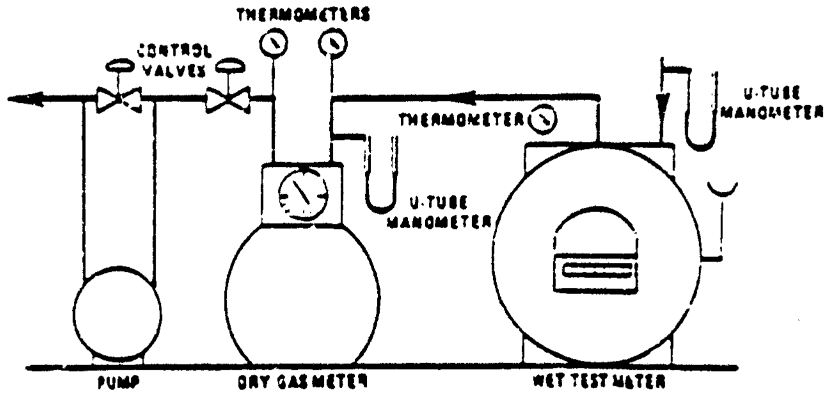

Figure 5.7 . Equipment arrangement for dry-gas meter calibration.

7.1.1.3 Collect the data as shown in the example data sheet (see Figure 5-8). Make triplicate runs at each of the flow rates and at no less than five different flow rates. The range of flow rates should be between 10 and 34 liters/min (0.35 and 1.2 cfm) or over the expected operating range.

DATE: ______________________

DRY GAS METER IDENTIFICATION: ______________________

BAROMETRIC PRESSURE (P_b): ______________ in. Hg

APPROXIMATE FLOW RATE ($\bar{Q}$) cfm	SPIROMETER (WET METER) GAS VOLUME (V_s) ft^3	DRY GAS METER VOLUME (V_{dg}) ft^3	TEMPERATURES				DRY GAS METER PRESSURE (Δp) in. H_2O	TIME (θ) min.	FLOW RATE (Q) cfm	METER METER COEFFICIENT (Y_{ds})	AVERAGE METER COEFFICIENT ($\bar{Y}_{ds}$)
			SPIROMETER (WET METER) (t_s) °F	DRY GAS METER							
				INLET (t_i) °F	OUTLET (t_o) °F	AVERAGE ($\bar{t}_d$) °F					
0.40											
0.60											
0.80											
1.00											
1.20											

$$Q = 17.38 \cdot \frac{V_s}{\theta} \cdot \frac{P_b}{(t_s + 460)}$$

$$Y_{ds} = \frac{V_s}{V_{dg}} \cdot \frac{(\bar{t}_d + 460)}{(t_s + 460)} \cdot \frac{P_b}{\left(P_b + \frac{\Delta p}{13.6}\right)}$$

Figure 5.8. Example data sheet for calibration of a standard dry gas meter for method 5 sampling equipment (English units).

7.1.1.4 Calculate flow rate, Q, for each run using the wet test meter gas volume, V_w, and the run time, θ. Calculate the dry gas meter coefficient, Y_m, for each run. These calculations are as follows:

$$Q = K_1 \frac{P_{bar}}{t_w + t_{std}} \frac{V_w}{\theta}$$

$$Y_m = \frac{V_w}{V_m} \frac{(t_m + t_{std})}{(t_w + t_{std})} \frac{P_{bar}}{\left(P_{bar} + \frac{\Delta p}{13.6}\right)}$$

Where:

K_1 = 0.3858 for international system of units (SI); 17.64 for English units.

V_w = Wet test meter volume, liters (ft³).

V_m = Dry gas meter volume, liters (ft³).

t_m = Average dry gas meter temperature, °C (°F).

t_{std} = 273° C for SI units; 460° F for English units.

t_w = Average wet test meter temperature, °C (°F).

P_{bar} = Barometric pressure, mm Hg (in. Hg).

Δp = Dry gas meter inlet differential pressure, mm H_2O (in. H_2O).

θ = Run time, min.

7.1.1.5 Compare the three Y_m values at each of the flow rates and determine the maximum and minimum values. The difference between the maximum and minimum values at each flow rate should be no greater than 0.030. Extra sets of triplicate runs may be made in order to complete this requirement. In addition, the meter coefficients should be between 0.95 and 1.05. If these specifications cannot be met in three sets of successive triplicate runs, the meter is not suitable as a calibration standard and should not be used as such. If these specifications are met, average the three Y_m values at each flow rate resulting in five average meter coefficients, $\overline{Y}_m$.

7.1.1.6 Prepare a curve of meter coefficient, $\overline{Y}_m$ versus flow rate, Q, for the dry gas meter. This curve shall be used as a reference when the meter is used to calibrate other dry gas meters and to determine whether recalibration is required.

7.1.2 Standard Dry Gas Meter Recalibration.

7.1.2.1 Recalibrate the standard dry gas meter against a wet test meter or spirometer annually or after every 200 hours of operation, whichever comes first. This requirement is valid provided the standard dry gas meter is kept in a laboratory and, if transported, cared for as any other laboratory instrument. Abuse to the standard meter may cause a change in the calibration and will require more frequent recalibrations.

7.1.2.2 As an alternative to full recalibration, a two-point calibration check may be made. Follow the same procedure and equipment arrangement as for a full recalibration, but run the meter at only two flow rates (suggested rates are 14 and 28 liters/min (0.5 and 1.0 cfm)). Calculate the meter coefficients for these two points, and compare the values with the meter calibration curve. If the two coefficients are within ±1.5 percent of the calibration curve values at the same flow rates, the meter need not be recalibrated until the next date for a recalibration check.

7.2 Critical Orifices As Calibration Standards. Critical orifices may be used as calibration standards in place of the wet test meter specified in Section 5.3, provided that they are selected, calibrated, and used as follows:

7.2.1 Section of Critical Orifices.

7.2.1.1 The procedure that follows describes the use of hypodermic needles or stainless steel needle tubings which have been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices; i.e., a critical vacuum can be obtained, as described in Section 7.2.2.2.3. Select five critical orifices that are appropriately sized to cover the range of flow rates between 10 and 34 liters/min or the expected operating range. Two of the critical orifices should bracket the expected operating range.

A minimum of three critical orifices will be needed to calibrate a Method 5 dry gas meter (DGM); the other two critical orifices can serve as spares and provide better selection for bracketing the range of operating flow rates. The needle sizes and tubing lengths shown below give the following approximate flow rates:

Gauge/cm	Flow rate (liters/min)	Gauge/cm	Flow rate (liters/min)
12/7.6	32.56	14/2.5	19.54
12/10.2	30.02	14/5.1	17.27
13/2.5	25.77	14/7.6	16.14
13/5.1	23.50	15/3.2	14.16
13/7.6	2.37	15/7.3	11.61
13/10.2	0.67	15/10.2	10.48

7.2.1.2 These needles can be adapted to a Method 5 type sampling train as follows: Insert a serum bottle stopper, 13- by 20-mm sleeve type, into a ½-inch Swagelok quick connect. Insert the needle into the stopper as shown in Figure 5-6.

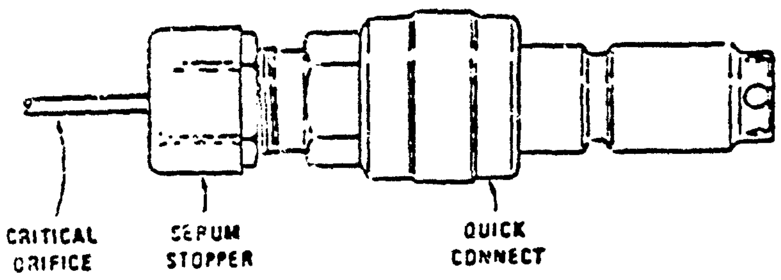

Figure 5-9. Critical orifice adaptation to Method 5 metering system.

7.2.2 Critical Orifice Calibration. The procedure described in this section uses the Method 5 meter box configuration with a DGM as described in Section 2.1.8 to calibrate the critical orifices. Other schemes may be used, subject to the approval of the Administrator.

7.2.2.1 Calibration of Meter Box. The critical orifices must be calibrated in the same configuration as they will be used; i.e., there should be no connections to the inlet of the orifice.

7.2.2.1.1 Before calibrating the meter box, leak check the system as follows: Fully open the coarse adjust valve, and completely close the by-pass valve. Plug the inlet. Then turn on the pump, and determine whether there is any leakage. The leakage rate shall be zero; i.e., no detectable movement of the DGM dial shall be seen for 1 minute.

7.2.2.1.2 Check also for leakages in that portion of the sampling train between the pump and the orifice meter. See Section 5.6 for the procedure; make any corrections, if necessary. If leakage is detected, check for cracked gaskets, loose fittings, worn O-rings, etc., and make the necessary repairs.

7.2.2.1.3 After determining that the meter box is leakless, calibrate the meter box according to the procedure given in Section 5.3. Make sure that the wet test meter meets the requirements stated in Section 7.1.1.1. Check the water level in the wet test meter. Record the DGM calibration factor, Y.

7.2.2.2 Calibration of Critical Orifices. Set up the apparatus as shown in Figure 5-10.

[illegible]

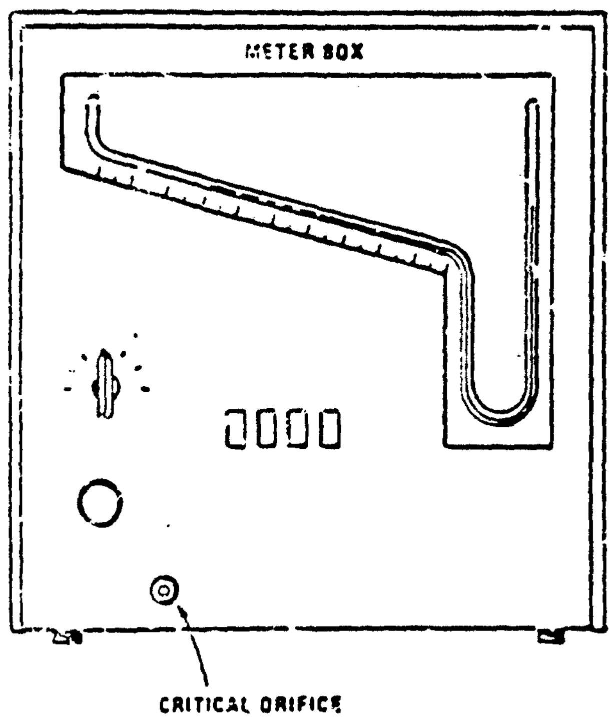

Figure 5-10. Apparatus setup.

7.2.2.2.1 Allow a warm-up time of 15 minutes. This step is important to equilibrate the temperature conditions through the DGM.

7.2.2.2.2 Leak check the system as in Section 7.2.2.1.1. The leakage rate shall be zero.

7.2.2.2.3 Before calibrating the critical orifice determine its suitability and the appropriate operating vacuum as follows: Turn on the pump, fully open the coarse adjust valve, and adjust the by-pass valve to give a vacuum reading corresponding to about half of atmospheric pressure. Observe the meter box orifice manometer reading, H. Slowly increase the vacuum reading until a stable reading is obtained on the meter box orifice manometer. Record the critical vacuum for each orifice.

Orifices that do not reach a critical value shall not be used.

7.2.2.2.4 Obtain the barometric pressure using a barometer as described in Section 2.1.9. Record the barometric pressure, P_{bar}, in mm Hg (in. Hg).

7.2.2.2.5 Conduct duplicate runs at a vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. The runs shall be at least 5 minutes each. The DGM volume readings shall be in increments of 0.00283 m³ (0.1 ft³) or in increments of complete revolutions of the DGM. As a guideline, the times should not differ by more than 3.0 seconds (this includes allowance for changes in the DGM temperatures) to achieve ± 0.5 percent in K'. Record the information listed in Figure 5-11.

7.2.2.2.6 Calculate K' using Equation 5-9.

K' = Critical orifice coefficient,

T_{amb} = Absolute ambient temperature, °K (°R).

Average the K' values. The individual K' values should not differ by more than ±0.5 percent from the average.

$$K' = \frac{K_1 V_m Y (P_{bar} + \Delta H/13.6) \sqrt{T_{amb}}}{P_{bar} T_m \Theta} \qquad \text{Eq. 5-9}$$

$$\frac{(m^3)(°K)^{1/2}}{(mm.\ Hg)\ (min)} \left[\frac{(ft^3)(°R)^{1/2}}{(in.\ Hg)\ (min)} \right]$$

Sections 7.2.2.2.1 to 7.2.2.2.5. Record the information listed in Figure 5.12.

7.2.3 Using the Critical Orifices as Calibration Standards.

7.2.3.1 Record the barometric pressure.

Date ______ Train ID ______ DGM cal. factor ______ Critical orifice ID ______

Dry gas meter		Run No. 1	Run No. 2
Final reading	m³ (ft³)		
Initial reading	m³ (ft³)		
Difference, V_m	m³ (ft³)		
Inlet/Outlet temperatures:			
Initial	°C (°F)	/	/
Final	°C (°F)	/	/
Avg. Temperature, t_m	°C (°F)		
Time, Θ	min/sec	/	/
	min		
Orifice man. rdg., ΔH	mm (in.) H_2O		
Bar. pressure, P_{bar}	mm (in.) Hg		
Ambient temperature, t_{amb}	°C (°F)		
Pump vacuum	mm (in.) Hg		
K' factor			
Average			

Figure 5-11. Data sheet for determining K' factor.

7.2.3.2 Calibrate the metering system according to the procedure outlined in

7.2.3.3 Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations below:"

$$V_m(std) = K_1\ V_m\ \frac{P_{bar} + (\Delta H/13.6)}{T_m} \qquad \text{Eq. 5-10}$$

$$V_{cr}(std) = K'\ \frac{P_{bar}\Theta}{T_{amb}} \qquad \text{Eq. 5-11}$$

$$Y = \frac{V_{cr(std)}}{V_{m(std)}} \qquad \text{Eq. 5-12}$$

where:

$V_{cr(std)}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions, dsm³ (dscf).

K_1 = 0.3858 °K/mm Hg for metric units = 17.64 °R/in. Hg for English units.

7.2.3.4 Average the DGM calibration values for each of the flow rates. The calibration factor, Y, at each of the flow rates should not differ by more than ±2 percent from the average.

7.2.3.5 To determine the need for recalibrating the critical orifices, compare the DGM Y factors obtained from two adjacent orifices each time a DGM is calibrated; for example, when checking 13/2.5, use orifices 12/10.2 and 13/5.1. If any critical orifice yields a DGM Y factor differing by more than 2 percent from the others, recalibrate the critical orifice according to Section 7.2.2.2.

Date ______ Train ID ______ Critical orifice ID ______ Critical orifice K' factor ______

Dry gas meter		Run No. 1	Run No. 2
Final reading	m³ (ft³)		
Initial reading	m³ (ft³)		
Difference, V_m	m³ (ft³)		
Inlet/outlet temperatures:			
Initial	°C (°F)	/	/
Final	°C (°F)	/	/
Avg. Temperature, t_m	°C (°F)		
Time, Θ	min/sec	/	/
	min		
Orifice man. rdg., ΔH	mm (in.) H_2O		
Bar. pressure, P_{bar}	mm (in.) Hg		
Ambient temperature, t_{amb}	°C (°F)		
Pump vacuum	mm (in.) Hg		
$V_{cr(std)}$	m³ (ft³)		
$V_{m(std)}$	m³ (ft³)		
DGM cal. factor, Y			

Figure 5-12. Data sheet for determining DGM Y factor

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July 1990
Revision: Final

EPA METHOD 3A

DETERMINATION OF OXYGEN AND CARBON DIOXIDE CONCENTRATIONS IN EMISSIONS FROM STATIONARY SOURCES

Method 3A—Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. *Applicability and Principle.*

1.1 Applicability. This method is applicable to the determination of oxygen (O_2) and carbon dioxide (CO_2) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A sample is continuously extracted from the effluent stream: a portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). Performance specifications and test procedures are provided to ensure reliable data.

2. *Range and Sensitivity.*

Same as Method 6C, Sections 2.1 and 2.2, except that the span of the monitoring system shall be selected such that the average O_2 or CO_2 concentration is not less than 20 percent of the span.

3. *Definitions.*

3.1 Measurement System. The total equipment required for the determination of the O_2 or CO_2 concentration. The measurement system consists of the same major subsystems as defined in Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, Response Time, and Calibration Curve. Same as Method 6C, Sections 3.2 through 3.8, and 3.10.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. *Measurement System Performance Specifications.*

Same as Method 6C, Sections 4.1 through 4.4.

5. *Apparatus and Reagents.*

5.1 Measurement System. Any measurement system for O_2 or CO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe. A leak-free probe, of sufficient length to traverse the sample points.

5.1.2 Sample Line. Tubing, to transport the sample gas from the probe to the moisture removal system. A heated sample line is not required for systems that measure the O_2 or CO_2 concentration on a dry basis, or transport dry gases.

5.1.3 Sample Transport Line, Calibration Value Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.3 through 5.1.9, and 5.1.11, except that the requirements to use stainless steel, Teflon, and nonreactive glass filters do not apply.

5.1.4 Gas Analyzer. An analyzer to determine continuously the O_2 or CO_2 concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. The requirements for measuring and controlling the analyzer flow rate are not applicable if data are presented that demonstrate the analyzer is insensitive to flow variations over the range encountered during the test.

5.2 Calibration Gases. The calibration gases for CO_2 analyzers shall be CO_2 in N_2 or CO_2 in air. Alternatively, CO_2/SO_2, O_2/SO_2, or $O_2/CO_2/SO_2$ gas mixtures in N_2 may be used. Three calibration gases, as specified Section 5.3.1 through 5.3.3 of Method 6C, shall be used. For O_2 monitors that cannot analyze zero gas, a calibration gas concentration equivalent to less than 10 percent of the span may be used in place of zero gas.

6. *Measurement System Performance Test Procedures.*

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 3 and change the acceptance criteria for agreement among Method 3 results to 5 percent (or 0.2 percent by volume, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the type of gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sampling System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

7. *Emission Test Procedure.*

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 3.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias check. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as for tests conducted using Method 3 plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.

8. *Quality Control Procedures.*

The following quality control procedures are recommended when the results of this method are used for an emission rate correction factor, or excess air determination. The tester should select one of the following options for validating measurement results:

8.1 If both O_2 and CO_2 are measured using Method 3A, the procedures described in Section 4.4 of Method 3 should be followed to validate the O_2 and CO_2 measurement results.

8.2 If only O_2 is measured using Method 3A, measurements of the sample stream CO_2 concentration should be obtained at the sample by-pass vent discharge using an Orsat or Fyrite analyzer, or equivalent. Duplicate samples should be obtained concurrent with at least one run. Average the duplicate Orsat or Fyrite analysis results for each run. Use the average CO_2 values for comparison with the O_2 measurements in accordance with the procedures described in Section 4.4 of Method 3.

8.3 If only CO_2 is measured using Method 3A, concurrent measurements of the sample stream CO_2 concentration should be obtained using an Orsat or Fyrite analyzer as described in Section 8.2. For each run, differences greater than 0.5 percent between the Method 3A results and the average of the duplicate Fyrite analysis should be investigated.

9. *Emission Calculation.*

For all CO_2 analyzers, and for O_2 analyzers that can be calibrated with zero gas, follow Section 8 of Method 6C, except express all concentrations as percent, rather than ppm.

For O_2 analyzers that use a low-level calibration gas in place of a zero gas, calculate the effluent gas concentration using Equation 3A-1.

$$C_{gas} = \frac{C_{ma} - C_{oa}}{C_m - C_o}(\bar{C} - C_m) + C_{ma}$$

Eq. 3A-1

where:

C_{gas} = Effluent gas concentration, dry basis, percent.

C_{ma} = Actual concentration of the upscale calibration gas, percent.

C_{oa} = Actual concentration of the low-level calibration gas, percent.

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent.

C_o = Average of initial and final system calibration bias check responses for the low-level gas, percent.

$\bar{C}$ = Average gas concentration indicated by the gas analyzer, dry basis, percent.

10. *Bibliography.*

Same as bibliography of Method 6C.

4.2.5 To insure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three of four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.2.6 Repeat the analysis until the following criteria are met:

4.2.6.1 For percent CO_2, repeat the analytical procedure until the results of any three analyses differ by no more that (a) 0.3 percent by volume when CO_2 is greater than 4.0 percent or (b) 0.2 percent by volume when CO_2 is less than or equal to 4.0 percent. Average the three acceptable values of percent CO_2 and report the results to the nearest 0.1 percent.

4.2.6.2 For percent O_2, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when O_2 is less than 15.0 percent or (b) 0.2 percent by volume when O_2 is greater than or equal to 15.0 percent. Average the three acceptable values of percent O_2 and report the results to the nearest 0.1 percent.

4.2.6.3 For percent CO, repeat the analytical procedure until the results of any three analyses differ by no more than 0.3 percent. Average the three acceptable values of percent CO and report the results to the nearest 0.1 percent.

4.2.7 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before an after the analysis.

NOTE: Although in most instances only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Section 4.4.1 be used to validate the analytical data.

4.3 Multi-Point, Integrated Sampling and Analytical Procedure.

4.3.1 Both the minimum number of sampling points and the sampling point location shall be as specified in Section 3.3.1 of this method. The use of fewer points than specified is subject to the approval of the Administrator.

4.3.2 Follow the procedures outlined in Sections 4.2.2 through 4.2.7, except for the following: Traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4.4 Quality Control Procedures.

4.4.1 Data Validation When Both CO_2 and O_2 Are Measured. Although in most instances, only CO_2 or O_2 measurement is required, it is recommended that both CO_2 and O_2 be measured to provide a check on the quality of the data. The following quality control procedure is suggested.

NOTE: Since the method for validating the CO_2 and O_2 analyses is based on combustion of organic and fossil fuels and dilution of the gas stream with air, this method does not apply to sources that (1) remove CO_2 or O_2 through processes other than combustion, (2) add O_2 (e.g., oxygen enrichment) and N_2 in proportions different from that of air, (3) add CO_2 (e.g., cement or lime kilns), or (4) have no fuel factor, F_o, values obtainable (e.g., extremely variable waste mixtures). This method validates the measured proportions of CO_2 and O_2 for the fuel type, but the method does not detect sample dilution resulting from leaks during or after sample collection. The method is applicable for samples collected downstream of most lime or limestone flue-gas desulfurization units as the CO_2 added or removed from the gas stream is not significant in relation to the total CO_2 concentration. The CO_2 concentrations from other types of scrubbers using only water or basic slurry can be significantly affected and would render the F_o check minimally useful.

4.4.1.1 Calculate a fuel factor, F_o, using the following equation:

$$F_o = \frac{20.9 - \%O_2}{\%CO_2}$$

Eq. 3-3

Where:

$\%O_2$ = Percent O_2 by volume (dry basis).
$\%CO_2$ = Percent CO_2 by volume (dry basis).
20.9 = Percent O_2 by volume in ambient air.

If CO is present in quantities measurable by this method, adjust the O_2 and CO_2 values before performing the calculation for F_o as follows:

$$\%CO_2(adj) = \%CO_2 + \%CO$$

$$\%O_2(adj) = \%O_2 - 0.5\ \%CO$$

Where: %CO = Percent CO by volume (dry basis).

4.4.1.2 Compare the calculated F_o factor with the expected F_o values. The following table may be used in establishing acceptable ranges for the expected F_o if the fuel being burned is known. When fuels are burned in combination, calculate the combined fuel F_d and F_c factors (as defined in Method 19) according to the procedure in Method 19 Section 5.2.3. Then calculate the F_o factor as follows:

$$F_o = \frac{0.209\ F_d}{F_c}$$

Eq. 3-4

Fuel type	F_o range
Coal:	
Anthracite and lignite	1.016–1.130
Bituminous	1.083–1.230
Oil:	
Distillate	1.260–1.413
Residual	1.210–1.370
Gas:	
Natural	1.600–1.836
Propane	1.434–1.586
Butane	1.405–1.553
Wood	1.000–1.120
Wood bark	1.003–1.130

Calculated F_o values beyond the acceptable ranges shown in this table should be investigated before accepting the test results. For example, the strength of the solutions in the gas analyzer and the analyzing technique should be checked by sampling and analyzing a known concentration, such as air; the fuel factor should be reviewed and verified. An acceptability range of ±12 percent is appropriate for the F_o factor of mixed fuels with variable fuel ratios. The level of the emission rate relative to the compliance level should be considered in determining if a retest is appropriate, i.e., if the measured emissions are much lower or much greater than the compliance limit, repetition of the test would not significantly change the compliance status of the source and would be unnecessarily time-consuming and costly.

5. *Leak-Check Procedure for Orsat Ana*

Moving an Orsat analyzer frequ causes it to leak. Therefore, an Orsat lyzer should be throughly leak-checke site before the flue gas sample is introd into it. The procedure for leak-checkin Orsat analyzer is:

5.1.1 Bring the liquid level in eac pette up to the reference mark on the lary tubing and then close the pipette cock.

5.1.2 Raise the leveling bulb suffici to bring the confining liquid meniscus the graduated portion of the burette then close the manifold stopcock.

5.1.3 Record the meniscus position.

5.1.4 Observe the menicus in the bu and the liquid level in the pipette for n ment over the next 4 minutes.

5.1.5 For the Orsat analyzer to pas leak-check, two conditions must be met.

5.1.5.1 The liquid level in each pi must not fall below the bottom of the c lary tubing during this 4-minute interva

5.1.5.2 The meniscus in the burette not change by more than 0.2 ml during 4-minute interval.

5.1.6 If the analyzer fails the leak-c procedure, all rubber connections and cocks should be checked until the cau the leak is identified. Leaking stopc must be disassembled, cleaned, and greased. Leaking rubber connections be replaced. After the analyzer is reas bled, the leak-check procedure must b peated.

6. *Calculations*

6.1 Nomenclature.

M_d = Dry molecular weight, g/g-mole (l mole).
%EA = Percent excess air.
$\%CO_2$ = Percent CO_2 by volume (dry basi
$\%O_2$ = Percent O_2 by volume (dry basis).
%CO = Percent CO by volume (dry basis
$\%N_2$ = Percent N_2 by volume (dry basis).
0.264 = Ratio of O_2 to N_2 in air, v/v.
0.280 = Molecular weight of N_2 or CO, d ed by 100.
0.320 = Molecular weight of O_2 dividec 100.
0.440 = Molecular weight of CO_2 divide 100.

6.2 Percent Excess Air. Calculate the cent excess air (if applicable), by subst ing the appropriate values of percen CO, and N_2 (obtained from Section 4.1 4.2.4) into Equation 3-1.

% EA =

$$\frac{\%O_2 - 0.5\%\ CO}{0.264\%\ N_2 - (\%O_2 - 0.5\ \%\ CO)} \times$$

Equatio

NOTE: The equation above assumes ambient air is used as the source of O_2 that the fuel does not contain apprec amounts of N_2 (as do coke oven or blast nace gases). For those cases when appr ble amounts of N_2 are present (coal, oil natural gas do not contain apprec amounts of N_2) or when oxygen enrich is used, alternate methods, subject to proval of the Administrator, are require

6.3 Dry Molecular Weight. Use Equ 3-2 to calculate the dry molecular weig the stack gas

M_d = 0.440(%CO_2) + 0.320(%O_2) +

0.280(%N_2 + %

Equatio

NOTE: The above equation does not consider argon in air (about 0.9 percent, molecular weight of 37.7). A negative error of about 0.4 percent is introduced. The tester may opt to include argon in the analysis using procedures subject to approval of the Administrator.

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EPA METHOD 7E

DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

Method 7E—Determination of Nitrogen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. *Applicability and Principle*

1.1 Applicability. This method is applicable to the determination of nitrogen oxides (NO_x) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A gas simple is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental chemiluminescent analyzer for determination of NO_x concentration. Performance specifications and test procedures are provided to ensure reliable data.

2. *Range and Sensitivity*

Same as Method 6C, Sections 2.1 and 2.2.

3. *Definitions*

3.1 Measurement System. The total equipment required for the determination of NO_x concentration. The measurement system consists of the following major subsystems:

3.1.1 Sample Interface, Gas Analyzer, and Data Recorder. Same as Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.1.2 NO_2 to NO Converter. A device that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO).

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, and Response Time. Same as Method 6C, Sections 3.2 through 3.8.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. *Measurement System Performance Specifications*

Same as Method 6C, Sections 4.1 through 4.4.

5. *Apparatus and Reagents*

5.1 Measurement System. Any measurement system for NO_x that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe, Sample Line, Calibration Valve Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.1 through 5.1.9, and 5.1.11.

5.1.2 NO_2 to NO Converter. That portion of the system that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO). An NO_2 to NO converter is not necessary if data are presented to demonstrate that the NO_2 portion of the exhaust gas is less than 5 percent of the total NO_x concentration.

5.1.3 NO_x Analyzer. An analyzer based on the principles of chemiluminescence, to determine continuously the NO_x concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer.

5.2 NO_x Calibration Gases. The calibration gases for the NO_x analyzer shall be NO in N_2. Three calibration gases, as specified in Sections 5.3.1 through 5.3.3, of Method 6C, shall be used. Ambient air may be used for the zero gas.

6. *Measurement System Performance Test Procedures*

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Gas Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 7, and change all 5 percent performance values to 10 percent (or 10 ppm, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sample System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

6.4 NO_2 to NO Conversion Efficiency. Unless data are presented to demonstrate that the NO_2 concentration within the sample stream is not greater than 5 percent of the NO_x concentration, conduct an NO_2 to NO conversion efficiency test in accordance with Section 5.6 of Method 20.

7. *Emission Test Procedure*

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 7.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the system calibration drift test. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as the total time required to perform a run using Method 7, plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed, to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.

8. *Emission Calculation*

Follow Section 8 of Method 6C.

9. *Bibliography*

Same as bibliography of Method 6C.

APPENDIX C

DESCRIPTION OF CEM SYSTEM

C.0 DESCRIPTION OF CONTINUOUS EMISSION MONITORING SAMPLING SYSTEM

The CEM system used for gaseous pollutant monitoring by EPA Methods 3A, 7E, 10, and 25A is shown in Figure C-1. The sample gas handling system is shown in Figure C-2.

C.1 Sampling system. Exhaust gas is drawn from the duct or stack through a heated stainless steel (S.S.) probe that is inserted into the duct or stack through one of the test ports. A S.S. valve is located at the probe exit to permit introduction of certified zero and calibration span gases. A heated teflon line is used to transport the sample or zero/calibration gases to the Continuous Emission Monitoring (CEM) trailer. Temperatures are monitored at the exit of each section of line to ensure temperatures are above the sample dew point. Once inside the CEM trailer, the sample line enters a heated junction box where the sample is split into three fractions, and each fraction is directed to one of the following:

(a) Charleton Model SC-14 Sample Conditioner.
(b) Thermo Electron Model 900 Sample Conditioner.
(c) Direct Connection to Total Hydrocarbon Analyzers.

The Charleton Model SC-14 unit is an extractive sample conditioner that removes particulates and moisture from the sample gas. The extracted sample gas is passed through a sintered stainless bypass filter, which removes particulates down to 1 micron or less by an internal filtration technique. The filter is maintained at a temperature above the dew point of the sample gases.

The clean, filtered sample is then introduced to a permeation dryer where moisture is removed without condensation or dilution to achieve a sample dew point well below that of the ambient temperature. The clean, dried sample is then directed to the carbon monoxide (CO), carbon dioxide (CO_2), oxygen (O_2), and nitrous oxides (NO_x) analyzers using a teflon-headed sample pump.

The dilution ratio of the Thermo Electron Model 900 sample conditioner is a function of sample/dilution air pressure and capillary tube size. Once set, the dilution ratio is a constant. Sample concentrations are determined by multiplying the analyzer output times the dilution ratio. Nominal dilution ratio for the Thermo Electron Model 900 is 10 to 1.

In the J.U.M. Engineer VE-7 Total Hydrocarbon Analyzer, a S.S. sample filter and detector are contained in a temperature controlled oven. This permits the direct analysis of total hydrocarbons on a wet basis without condensation or loss of sample.

C.2 CEM system calibration procedures. Calibrations are conducted on a daily basis. The following procedures are performed each day of testing:

(a) Analyzer calibration error (pretest).
(b) Sampling system bias check (pretest).
(c) Sampling system bias check (post-test).

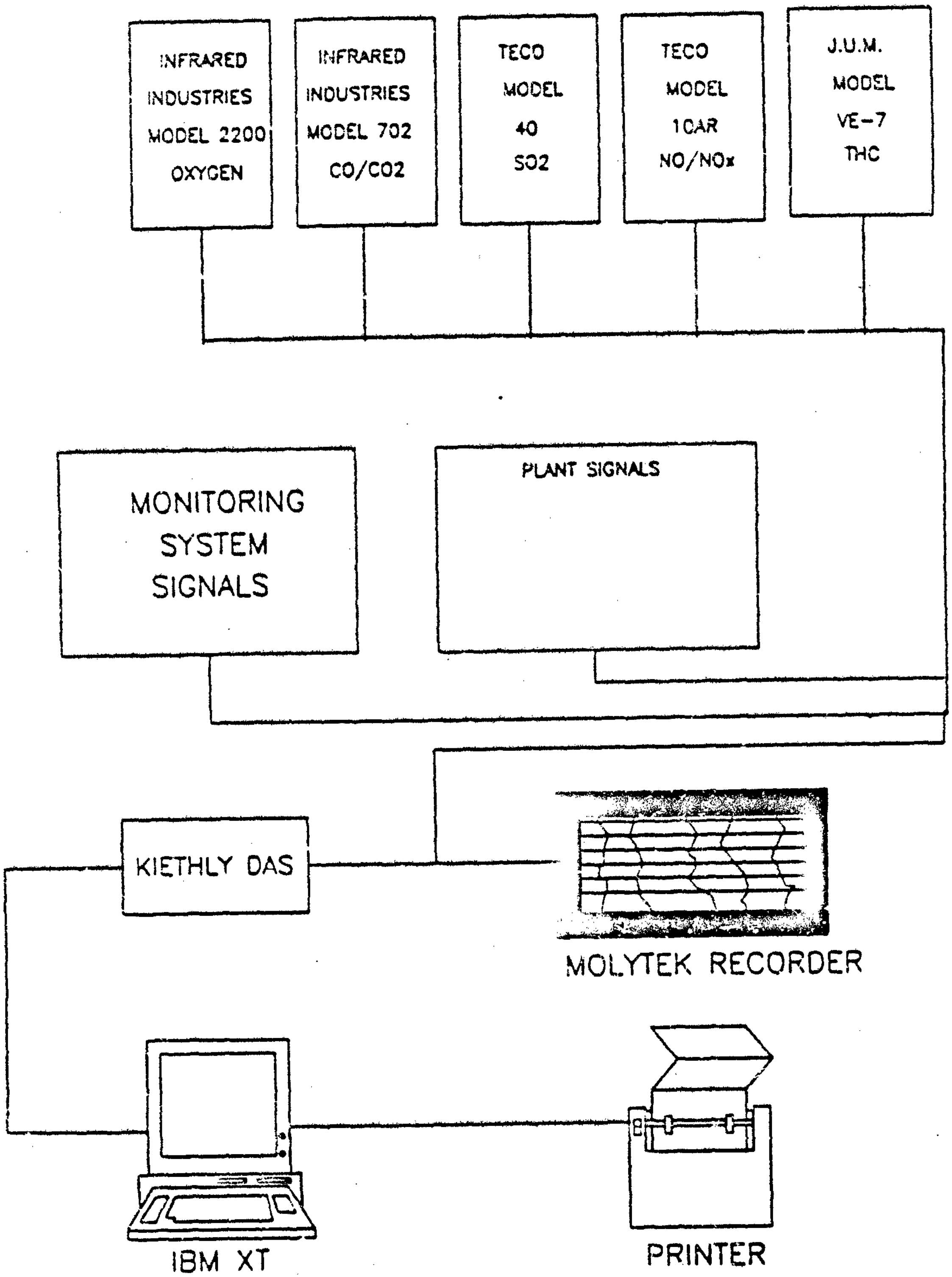


FIGURE C-1. CEM System

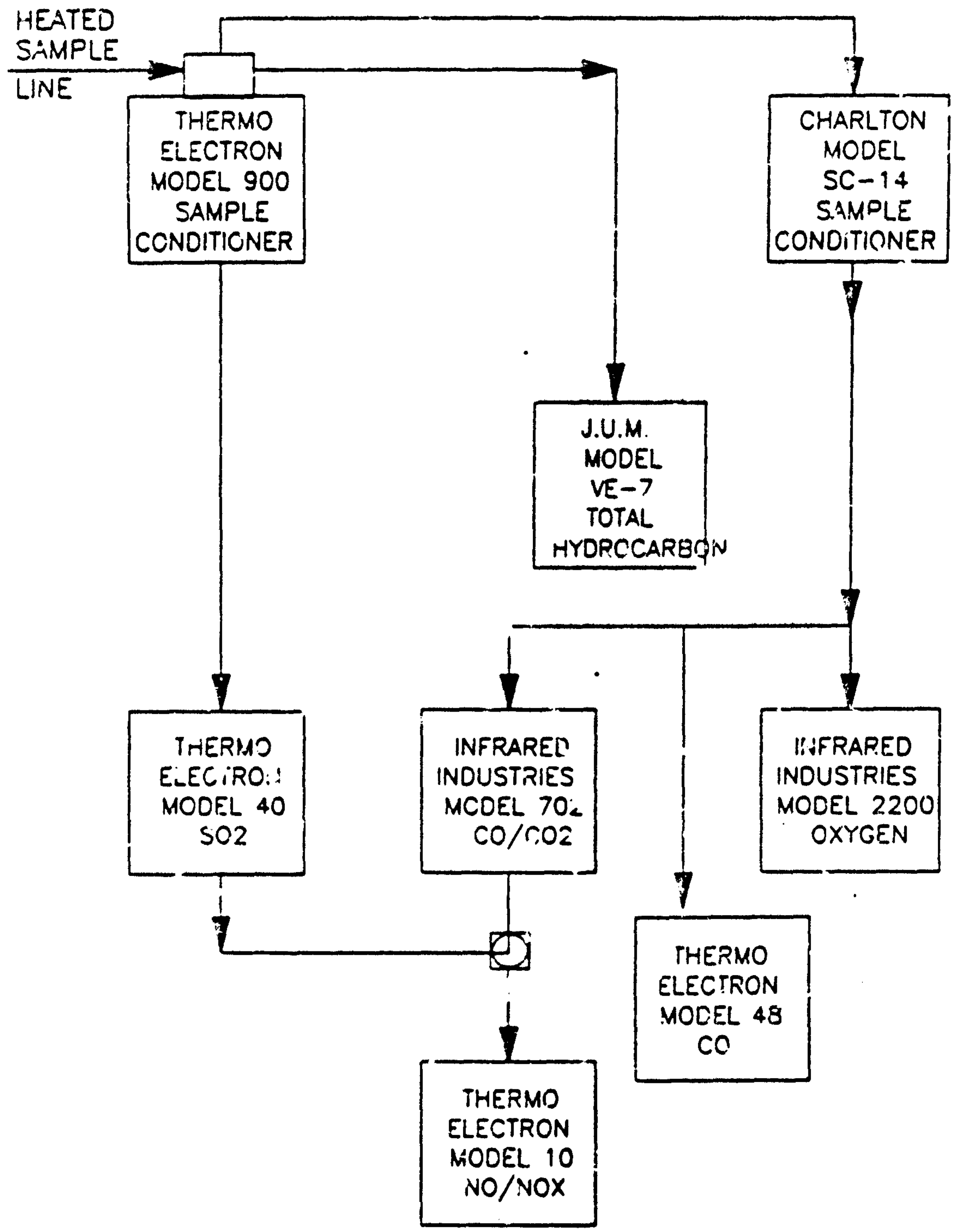


FIGURE C-2. CEM Sample Gas Flow Path

Calibrations used cylinder gas standards prepared according to EPA Protocol 1, where available. All other calibration gases are traceable to National Bureau of Standards (NBS) standards.

C.3 CEM system data dollection. Signals from the CEM sampling system are recorded on two devices. Data are available in hard copy from a Molytek strip chart recorder/data logger. In addition, data are recorded in 10-second increments using the Kiethly DAS/IBM PC-XT acquisition system. Data are summarized as one minute averages and are available onsite using the PC-XT system.

APPENDIX D

RAW OPERATIONAL DATA SHEETS

Appendix D presents raw operational data collected from process equipment and test items. For each test run, four types of data sheets are enclosed.

The first data sheet (Data Sheet 1) provides information on the physical characteristics of test items evaluated in each test run. The following information is provided:

- Equipment type.
- Contaminants evaluated.
- Dimensions of test item.
- Initial weight of test item.
- Final weight of test item.
- Type of sample collected (rinsate, wipe or solid).
- An indication of type of contaminant spiked to test item (TNT or ammonium picrate).
- Initial and final contaminant concentration (since these items were not known at the time of testing, these columns are generally left blank).
- Thermocouple number.
- Observations (pre- and post-test).

A schematic of the rail cart is included; locations of each type of test item are provided. The following abbreviations are applicable:

- PB - Powder Box.
- SHR - Steam Heated Riser.
- SSR - Shell Support Rack.
- SHV - Steam Heated Discharge Valve.
- CP - Clay Pipe.
- SM - Ship Mine.
- SP - Steel Pipe.
- AP - Aluminum Pipe.

- 1 - denotes test items designated for post-test sampling and analysis.

- 2 - denotes test items designated as spares; items were sampled for analysis only in the event of field or laboratory contamination.

- 0 - Diameter.
- F - Flush.
- R - Rinsate.
- W - Wipe.
- S - Side (thermocouple location).
- I - Inside (thermocouple location).

For the first few test runs, the procedures used to record data were still being developed; therefore, some of the information provided on the data sheets is not complete (i.e., contaminants evaluated, sample type, initial/final contaminant concentration, and thermocouple number).

The second data sheet (Data Sheet 2) provides information collected from the following process equipment items:

- Main Control Panel
  - Air preheater inlet damper position (H1C-201)
  - Air preheater inlet air flow (PI-202)
  - Air preheater exit gas temperature (TIC-304)
  - Afterburner inlet air temperature (TI-224)
  - Building (Flash Chamber) Pressure (PIC-201)
  - Afterburner exit gas temperature (TIC-324)
- Air Preheater
  - Gas Pressure (PI-303)
  - Burner Pressure (PI-310)
- Afterburner
  - Gas Pressure (PI-323)
  - Burner Pressure (PI-330)
- Propane Gas Supply Tank
  - Tank Capacity Remaining
  - Tank Temperature
  - Line Pressure
  - Line Temperature

The following discharge emissions were monitored by the Continuous Emissions Monitor (CEM) System and recorded by WESTON personnel:

- Air Preheater Discharge
  - Total Hydrocarbons (THC)
- Flash Chamber Discharge
  - Total Hydrocarbons (THC)
- Afterburner Discharge
  - Total Hydrocarbons (THC)
  - Carbon Dioxide (CO)
  - Carbon Monoxide (CO_2)
  - Oxygen (O_2)
  - Nitrous Oxides (NO_x)

The following key o ·bbreviations is applicable:

- PSIG = Pounds per Square Inch Gauge.
- PPM/V = Parts Per Million based on Volume.
- % = Percentage.

The following information was monitored and recorded by WESTON personnel:

- Dry bulb temperature of ambient air.
- Wet bulb temperature of ambient air.
- Moisture content of ambient air (as determined using a psychrometric chart).

The collection times correspond to real time beginning with 0000 hrs and running through 2300 hrs. A separate data sheet is included for each operational day.

Monitoring data were collected and recorded every hour beginning with the firing of the afterburner and continuing until the flash chamber reached the steady state target temperature. After reaching steady state temperature, personnel were not required to be present on the test site. The team left the site and the system operated automatically. During unmanned operation, no data were recorded (except for data recorded during "spot" checks and CEM system data). Data gaps, therefore, exist in the data sheets.

WESTON personnel recorded notes regarding the operation of the system along the sides of the data sheets. These notes usually reflect times when the system reached steady state, and cases where the system shut down, the air preheater started, etc.

The third data sheet (Data Sheet 3) provides temperatures monitored by thermocouples placed on test items within and various locations in the flash chamber. Collection times correspond to real time beginning with 0030 hours and continuing to 2330 hours. Each thermocouple was tagged with an identification number. The thermocouple number is provided across the top of the data sheet (numbers 1 through 20). The test item and flash chamber location monitored are listed below the thermocouple number (i.e., thermocouple 1 monitored the temperature of the diffuser support, etc.). The location of the thermocouple on the test items is provided and is listed as an (I) for internal surfaces or (S or E) for side and external surface areas.

Following the raw data sheets are computer-generated summary sheets (Data Sheet 4). Two data summary sheets are provided for each test. The first sheet contains data collected from the process equipment; the second sheet contains the temperatures collected from the test items and flash chamber. The elapsed time is provided and represents the total number of hours data were collected during a test period. At the end of each summary sheet are values for the mean, maximum, and minimum of the data over the following three time periods: (1) steady state operation, (2) heatup and steady state operation, and (3) total test operation. The averages generated by the computer were used to generate summary tables in Section 8 of the report.

TEST RUN 2
400°F/24 HOURS

DATA SHEET 1
PAGE 1 OF 1

Test Run T2
Test Duration 24 hrs
Heat-Up Rate 50/hr
Flash Chamber Temperature 400 °F

Date 7-18-89
Time 1200 hrs

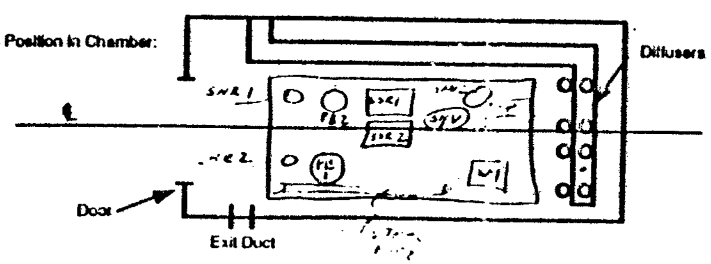
Flash Chamber Interior

I = inside
S = side

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt. (lbs.)	Final Wt. (lbs.)	Sample Type		Equipment Spikes	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. PB1	TNT	16"Ø x 14"	12	12	F	R	TNT			12 S		
2. PB2	explosives	15"Ø x 14"	6	6	F	R	↓					
3. SHR1	"	7"Ø x 9"	13	12	—	R	↓			15 I		
4. SHR2	"	7"Ø x 9"	13	12	—	R	↓					
5. SSR-1	explosives	36" x 20" x 9"	85	80	W	W	↓					
6. SSR-2	"	36" x 20" x 6"	87	67	W	W	↓			11 S		
7. SHV-1		33.5"d, 12"h	210	210	—	R	↓			16 I		
8. SHV-2		32.5"d, 12"h	190	190	—	R	↓				no sampler	
9. CP			88	81						20 I 18 S		
10. SM			728	731						19 I 17 S		
11. SP										14 S		
12.												
13.												
14.												
15.												

177 857a

Equipment Position in Chamber:



1 = diffuser support
2 = rear floor
3 = right wall
4 = floor on right
5 = diffuser
6 = left wall
7 = exit gas
8 = floor of tail car
9 = roof

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DATA SHEET 2
PAGE 1 OF 3

Date 24 July 89 Test Number T-2 400 °F 24 hr test

Time	Main Panel: Air Heater Inlet Damper HIC-201	Main Panel: Air Heater Inlet Air Flow PI-202 (IWC)	Main Panel: Air Heater Temperature TIC-204 (°F)	Main Panel: T.O. Inlet Air Temperature TI-204 (°F)	Main Panel: Bag. Pressure PIC 221 (IWC)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-224 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Afterburner: Burner Pressure PI-324 (PSIG)		Propane Tank: Capacity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Air Heater Discharge THC (light off) (PPmv)	Flash Chamber Discharge THC (light off) (PPmv)	Afterburner Discharge THC (ppm)	Afterburner Discharge CO_2 (%)	Afterburner Discharge CO (ppm)	Afterburner Discharge O_2 (%)	Afterburner Discharge NO_x (ppm)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100																									
1200																									
1300																									
1400																									
1500																									
1600																									
1700																									
1800																									
1900	0.0	[illegible]0	31.0	56.0	-0.16	0	470	87/69	0	0						80	21	95							
2000																									
2100	0.0	-0.06	23	56	-0.16	0	613	80/66	↓	↓		19	0.2			18	20.5	100							
2200	0.0	-0.06	21	55	-0.16	0	577	82/68	↓	↓		19	0.2			16	20.5	12	0.8		0.6	1.5	12.1	17.6	10.4
2300	0.0	-0.06	19	54	-0.15	0	583	80/68	↓	↓		18.8	0.2			16	20	94	0.8		0.7	1.6	18.4	17.9	11.7

(28) (22)

0700 started after burner
0115 [illegible] test state

lb H_2O / lb dA

.0112

DATA SHEET 2
PAGE 2 OF 3

Date 25 JULY 89 Test Number T-2 400°F/24 hr Test

0800 - started Afterburner
0830 Start [illegible]
0810 Low [illegible] Temp Alarm
2040 - HIGH PRESS. ALARM.
1430 (7/25/89) STEADY STATE OCCURS.
1730 -
1730 - Pipe Burner [illegible]
2335 - 2nd STACK TEST COMPLETE

#	Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow PI-202 (INWC)	Air Heater Temperature TC-204 (°F)	T.O. Inlet Air Temperature TI-224 (°F)	Bag. Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TC-324 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Heater: Gas Pressure PI-805 (PSIG)	Air Heater: Burner Pressure PI-810 (PSIG)	Afterburner: Gas Pressure PI-321 (PSIG)	Afterburner: Burner Pressure PI-30 (PSIG)
5	0000	0	-0.02	15	53	-0.16	0	311	73/61	0	0	18.0	0.3
6	0100	0	-0.01	11	52	-0.11	0	177		0	0	18	0.7
7	0200	0	-0.07	10	51	-0.16	0	1125		0	0	12.4	1.2
8	0300	0	-0.07	10	51	-0.15	0	1364		0	0	11.8	1.2
9	0400	0	-0.08	B	51	-0.15	0	[illegible]		0	0	16.4	1.7
10	0500	0	-0.07	B	51	-0.14	0	1722		0	0	17.8	2.1
11	0600	0	-0.07	B	51	-0.14	0	1892		0	0	15.2	5.1
12	0700	0	-0.07	B	52	-0.11	0	2016		0	0	16	3.8
13	0800												
14	0900	[illegible]	0.65	305	—	-0.06	0	1876		16	1.6	14.5	6.1
15	1000	61	0.86	750	—	-0.07	0	[illegible]		8.1	1.7	14.4	6.1
16	1100	62.7	0.92	790	—	-0.4	0	172	/65	16.0	1.5	11.7	6.4
17	1200	62.7	0.96	790	—	0.61	0	184				14.0	6.3
18	1300	62.7	0.76	751		0.04	0	[illegible]		16.2	1.4	14.8	6.[illegible]
19	1400	62.7	0.12	725	-	0.09	0	1814		16.3	1.7	14.8	6.3
20	1500	62.7	0.91	781	-	0.05	0	[illegible]		16.0	1.8	14.8	6.4
21	1600	62.7	0.97	815	-	-0.05	0	1827		16.0	2.0	14.6	6.4
22	~~1700~~	62.7	0.96	793	-	0.4	0	1917		16.0	1.9	15.[illegible]	6.5
23	1830	62.7	1.03	776	-	-0.01	0	1821		16.1	1.8	14.1	6.1
21	1900	66.2	1.05	775		-0.05	0	1823		16.6	1.9	14.4	6.1
25	2000	68	1.13	718	-	-0.07	0	1807		16.4	1.8	15	6.5
26	2100	68	1.12	715	-	-0.09	0	1825		16.2	1.8	14.8	6.5
27	2200	68	1.14	711	-	-0.03	0	1821		16.2	1.8	14.8	6.5
24	2300	70	1.16	715	-	-0.07	0	1841		16.2	1.8	14.1	6.5

Time	Propane Tank: Capacity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (LIGHT ON) (PPmv)	Flash Chamber Discharge THC (LIGHT OFF) (PPmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000		74	20	100	0.7		0.6	1.9	18.7	16.8	19.2
0100		74	20	76	0.6		0.1	3.1	15.4	15.4	22
0200		72	20	104	0.6		0.4	4.0	5.5	14.1	31
0300		72	20	110		1.1	0.4	3.9	5.5	14.1	2.8
0400		70	19.5	120	0.7	-	0.5	6.5	0.2	12.2	52.8
0500		70	20	122	0.6	-	0.4	8.0	4.7	4.2	[illegible]
0600	202	70	19.5	122		1.1 -	0.6	8.2	2.4	7.6	[illegible]
0700		70	19.5	126		-	0.4	7.1	1.4	9.5	61.3
0800											
0900		70	19	132		27.2	0	7.1	1.4	10	[illegible]
1000			19	120		23.5 -	0.1	7.6	1.3	7.4	[illegible]
1100		70	19	13[illegible]	31.2	24.6	0.0	7.4	1.2	9.6	[illegible]
1200		80	19.[illegible]	12[illegible]	30.4	24.[illegible]	0.2	7.1	1.1	9.5	[illegible]
1300		80	19.5	120	30.[illegible]	22.6	0.2	7.[illegible]	1.1	10.[illegible]	64.5
1400		80	19.5	120	29.[illegible]	23.1	0.3	7.2	1.5	7.9	[illegible]
1500		80	19.5	120	26.[illegible]	23.4	0.6	6.[illegible]	1.4	11.[illegible]	60.4
1600		80	19.5	119							
~~1700~~		80	19.5	120	30.[illegible]	24.8	0.1	7.2	[illegible]	[illegible]	[illegible]
1830		80	19.5	110	26.0	26.6	0.[illegible]	6.5	[illegible]	10.1	51.[illegible]
1900		82	19.5	120	34.1	25.5	0.1	6.[illegible]	0.8	10.9	51.4
2000		82	19.5	102		33.1 -	0.2	6.2	2.7	11.1	[illegible]
2100		80	19.5	100	43.6	-	0.3	6.3	0.4	11.1	50.0
2200		80	19.5	96	46.5	-	0.2	6.3	0.5	11.0	52.4
2300		80	19.5	98	41.9	-	0.3	6.4	[illegible]	11.0	52.4

28 32

Ap [illegible]

23 3

3 8 3

DATA SHEET 2
PAGE 3 OF 3

Date 7/26/89 Test Number T-2 400°F/24 hrs

	Time	Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202	Air Heater Temperature TIC-20X	T.O. Inlet Air Temperature	Stag. Pressure PIC 221	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-224	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater Gas Pressure	Air Preheater Burner Pressure	After Burner Gas Pressure PI-373	After Burner Burner Pressure	Propane Tank Capacity	Tank Temperature	Line Pressure	Line Temperature	Air Heater Discharge THC (LIGHT ON)	Flash Chamber Discharge THC (LIGHT OFF)	Afterburner Discharge THC	CO2	CO	O2	NOx
			INWC	°F	°F	INWC		°F		PSIG	PSIG	PSIG	PSIG	Gal	°F	PSIG	°F	PPMV	PPMV	ppm	%	ppm	%	ppm
34	0000	68.3	1.17	691	–	-0.07	0	1855		14.4	1.8	15	6.2		80	11.5	94	3.0	-	0.2	6.3	0.1	11.1	37.7
~~30~~	0100							1800																
31	0200																							
~~32~~	0300							1806																
~~33~~	0400							1800																
31	0500																							
~~33~~	0600							1820																
~~36~~	0700							1810																
31	0800	69.3	1.25	699	–	-0.07	0	1798		16.2	1.6	14.3	6.0		76	17.0	120	2.0	43.6 -	0.1	6.2	16	11.2	[illegible]
36	0900	69.3	1.25	650	–	-0.09	0	1819		16.2	1.6	14.6	6.6		76	11.5	125		calibrating					
39	1000	69.3	1.33	665	–	-0.07	0	1807		16.3	1.6	14	6.4		76	17.5	120	[illegible]	58.0	0.1	6.1	2	11.4	37
40	1100	69.3	1.5	678	–	-0.06	0	1811		16.0	1.6	14.6	6.4		76	11.0	124	36.0	46.6	0.1	6.6	1.6	11.6	41
41	1200	69.3	1.30	692	–	-0.04	0	1817		16.0	1.6	14.1	6.4		78	11.2	124	45.0	35.0	2.1	5.5	2.2	11.2	41
40	1300																							
43	1400	67.2	1.1	7?1		0.04	0	1842		16.0	1.6	16.0	6.1		80	19.5	110	[illegible]	926	0.1	6.4	1.5	[illegible]	39
44	1500	[illegible]	3.67	494		-0.02	0	1851				15.1	5.1		80	10	117							13
45	1600	60	0.91	48	·	-0.05	0	1842				15.1	5.1	40%	78	12	114		< 1.0	0.1	5.5	1.4	12	14
46	1700	65	1.12	48		-0.02	0	1832							80	20	120		1.7	0.2	5.8	0.4	12	11.2
~~47~~	1800							1800																
45	1900																							
~~49~~	2000							[illegible]																
50	2100							[illegible]																
51	2200																							
~~52~~	2300							1820																

0800 Autoanalyzer off

0945 samples shut off

1450 stopped [illegible]

28 3/2

1/6/2

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Equip.											S	S			I	I	S	S	I	I										
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SP	[illegible]	[illegible]	SM	CP	SM	CP										
	0030	55	55	55	55	55	220	220	220	220	220	420	420	420	420	420	420	620	620	620	620										
	0130	50	50	50	50	50	215	215	215	215	215	418	418	418	418	418	618	618	618	618	618										
	0230																														
	0330	50	50	50	50	50	215	215	215	215	215	415	415	415	415	415	615	615	615	615	615										
	0430																														
	0530	50	50	50	50	50	215	215	215	215	215	415	415	415	415	415	613	613	613	613	613										
	0630	50	50	50	50	50	215	215	215	215	215	415	415	415	415	415	613	613	613	613	613										
13	0800	103	105	111	117	99	98	93	94	116	98	100	100	110	103	100	105	101	98	105	100										
14	0830	201	110	115	116	212	215	246	124	141	156	150	150	117	124	110	105	154	153	105	104										
15	1000	301	149	133	127	371	357	340	225	234	212	282	271	174	253	219	163	324	232	232	183										
16	1100	335	178	202	146	387	371	360	257	260	233	313	301	179	288	266	214	351	334	280	237										
17	1130	[illegible]	182	209	150	399	375	364	257	246	232	323	307	204	292	276	228	355	339	281	242										
18	1230	378	205	231	168	412	389	381	281	285	249	338	378	222	314	305	264	372	355	316	298										
19	1330	405	222	246	181	420	401	379	296	276	256	359	348	233	341	328	296	368	370	335	332										
20	1430	416	231	256	181	430	407	402	[illegible]	[illegible]	261	358	349	242	334	333	310	395	351	345	342										
21	1530	421	250	267	201	431	416	391	313	318	264	365	356	251	343	346	332	403	356	360	360										
22	1630																														
23	1730	443	267	282	216	453	431	428	334	332	270	377	380	267	361	364	354	422	400	377	393										
24	1830	438	277	[illegible]	223	450	432	406	336	[illegible]	287	390	376	278	363	368	364	425	411	386	420										
25	1930	446	[illegible]	296	232	455	440	421	348	345	291	394	382	367	374	377	418	411	420	391	404										
26	2030	448	[illegible]	300	[illegible]	453	404	418	[illegible]	418	[illegible]	400	387	281	372	378	377	432	421	395	406										
27	2130	447	[illegible]	304	[illegible]	458	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	375	382	402	435	422	400	408										
28	2230	456	[illegible]	310	244	462	440	427	358	356	305	404	396	290	379	387	387	438	425	403	410										
29	2330	459	304	314	248	466	449	429	361	360	307	414	380	291	383	390	391	442	430	407	414										

177-857c

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

1/26/80 Test - 1-2 400 °F/24 hr. DATA SHEET 3 Page 2 of 2 2.12

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Equip.	[illegible]										S	S			I	I	S	S	I	I										
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PB	[illegible]	SM	[illegible]	[illegible]	SM	CP	SM	CP										
30	0030	456	396	317	351	463	443	427	362	362	307	411	399	356	383	383	383	442	433	404	416										
31	0130	96	96	96	96	96	290	290	290	290	278	485	485	465	485	485	685	685	685	685	685										
[illegible]	0230																														
33	0330	96	96	96	96	96	290	290	290	290	278	485	485	465	485	485	685	685	685	685	685										
34	0430	96	96	96	96	96	290	290	290	290	280	485	455	465	485	455	685	685	685	685	665										
[illegible]	0530																														
36	0630	98	98	98	98	98	295	295	295	295	280	485	485	470	485	485	685	685	685	685	685										
37	0730	97	97	97	97	97	292	292	292	292	280	485	485	470	485	[illegible]	[illegible]	685	685	685	685										
38	0830	460	327	336	[illegible]	403	413	436	387	373	323	413	401	326	312	403	407	441	412	411	415										
39	0930	[illegible]	317	332	274	462	444	422	371	374	324	415	408	317	391	402	407	446	437	414	424										
[illegible]	1030	[illegible]	[illegible]	338	[illegible]	466	446	459	384	375	332	421	414	320	354	404	407	450	437	417	415										
41	1130	464	331	310	278	464	[illegible]	434	373	372	327	417	413	322	345	405	406	450	434	421	416										
[illegible]	1230	464	332	345	[illegible]	472	442	437	385	381	331	415	415	325	395	407	400	457	442	404	425										
[illegible]	1330																														
[illegible]	1430 [illegible]																														
[illegible]	1530 [illegible]																														
46	1630	327	291	301	[illegible]	212	279	243	283	330	267	265	293	288	311	334	383	305	281	[illegible]	350										
47	1730																														
48	1830	50	50	50	50	50	240	245	245	245	240	450	450	450	450	450	645	650	645	658	658										
49	1930																														
50	2030	45	45	45	45	45	240	235	240	255	240	440	440	445	440	445	655	645	640	650	650										
51	2130	45	45	45	45	45	240	240	240	250	235	435	440	440	440	440	655	635	635	640	640										
[illegible]	2230																														
53	2330	35	35	35	40	35	235	230	235	248	235	435	435	440	440	440	645	640	635	[illegible]	640										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

Test Number	T-3		Run 6		
Temperature	600 Deg F	Heat-up Start	30		
Time	24 Hours	Steady State Start	36	Range #1 [illegible]	
Date of Test	24-Jul-88	Steady State Stop	60	Range #2 [illegible]	
		Test End	80	Range #3 [illegible]	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-201	FI-202	TIC-306	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(InWC)	(Deg F)	(Deg F)	(InWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0	0.00	0.00	31.00	56.00	-0.15	470.00	0.00	0.00			0.00	21.00	95.00							
100																				
200	0.00	-0.06	23.00	56.00	-0.16	613.00	0.00	0.00	10.00	0.30	78.00	20.50	100.00							
300	0.00	-0.06	21.00	55.00	-0.16	577.00	0.00	0.00	10.00	0.30	76.00	20.50	92.00	0.80		0.60	1.50	17.90	17.60	10.40
400	0.00	-0.06	19.00	54.00	-0.15	523.00	0.00	0.00	10.60	0.30	76.00	20.00	94.00	0.80		0.70	1.60	18.40	17.40	11.70
500	0.00	-0.06	15.00	53.00	-0.15	[illegible]	0.00	0.00	10.60	0.30	74.00	20.00	106.00	0.70		0.60	1.96	18.70	16.60	14.30
600	0.00	-0.06	11.00	52.00	-0.16	977.00	0.00	0.00	10.00	0.70	74.00	20.00	96.00	0.60		-0.10	3.10	15.60	15.40	22.00
700	0.00	-0.07	10.00	51.00	-0.16	1185.00	0.00	0.00	17.40	1.30	72.60	20.00	104.00	[illegible]						
800	0.00	-0.07	10.06	51.00	-0.15	1364.00	0.00	0.00	17.00	1.80	72.00	22.00	110.00		1.10	-0.40	3.90	3.50	14.10	31.00
900	0.00	-0.06	8.00	51.00	-0.15	1644.00	0.00	0.00	16.60	1.90	70.00	19.50	128.00	0.70		-0.50	6.50	0.30	12.30	50.00
1000	0.00	-0.07	8.00	51.00	-0.11	1740.00	0.00	0.00	17.40	2.10	70.00	20.00	[illegible]	0.60		-0.40	6.00	0.70	14.20	42.00
1100	0.00	-0.07	8.00	51.00	-0.14	1832.90	0.00	0.00	15.30	3.10	70.00	19.50	122.00		1.10	-0.60	8.00	-0.40	7.80	109.00
1200	0.00	-0.60	8.00	52.00	-0.14	2016.00	0.00	0.00	16.00	3.00	70.00	19.50	126.00			0.40	9.10	-1.40	8.50	64.30
1300																				
1400	11.00	0.65	465.00		-0.66	1876.00	16.00	1.60	14.40	6.10	79.00	19.00	132.00		27.20	0.00	9.10	1.40	10.00	48.40
1500	61.00	0.80	750.00		-0.64	1844.00	16.20	1.70	14.40	6.40		18.00	130.00		23.50	-0.10	7.69	1.30	9.40	53.50
1600	64.30	0.87	790.00		-0.84	1776.00	16.00	1.50	14.40	6.40	70.00	19.60	130.00	31.20	24.60	0.00	7.40	1.30	9.00	56.66
1700	67.10	0.96	745.00		-0.85	1846.00			14.60	6.30	64.00	19.50	120.00	30.96	24.00	0.30	7.10	1.60	8.50	71.60
1800	63.10	0.86	752.86		-0.84	1816.00	16.30	1.40	14.00	6.30	80.00	19.50	120.00	30.00	22.60	0.30	7.00	1.60	10.00	64.50
1900	63.70	0.82	[illegible]		-0.87	1819.00	16.30	1.70	14.60	6.30	80.00	19.50	130.00	[illegible]	27.10	0.30	7.30	1.50	9.90	65.60
2000	63.70	0.80	781.00		-0.83	1852.00	15.60	1.20	14.00	5.40	80.60	19.50	110.00	30.00	23.00	0.60	6.50	1.60	11.60	60.40
2100	62.70	0.87	818.00		-0.35	[illegible]	16.00	2.00	14.50	6.00	80.30	19.50	114.00							
2200	63.70	0.86	793.00		-0.83	1817.00	16.00	1.00	15.60	6.50	80.00	19.50	[illegible]	30.60	34.00	0.10	7.60	6.00	9.00	60.70
2300	66.20	1.03	[illegible]		-0.85	1833.00	[illegible]	1.00	14.00	6.60	80.00	19.50	110.00	36.00	36.60	0.00	[illegible]	-0.60	10.70	51.50
2400	66.20	1.06	[illegible]		-0.85	1823.00	16.00	1.00	15.00	6.40	83.50	19.50	128.00	34.10	25.50	-0.10	6.20	-0.80	10.90	51.40
2500	65.60	1.13	710.00		-0.87	1807.00	16.40	1.90	15.00	6.50	82.00	19.53	102.00		33.10	-0.20	6.20	-0.70	11.10	48.60
2600	68.70	1.13	715.00		-0.80	1825.00	[illegible]	1.30	14.60	6.50	80.00	19.50	100.00	43.60		-0.30	6.30	-0.40	11.10	50.00
2700	68.00	1.16	711.00		-0.83	1821.00	16.20	[illegible]	14.60	6.50	80.00	19.50	96.60	45.50		-0.30	6.30	-0.50	11.00	50.40
2800	70.00	1.16	713.00		-0.87	1841.00	[illegible]	1.00	14.50	6.50	80.00	19.50	90.00	41.50		-0.30	6.40	-0.40	11.00	52.20
2900	68.30	1.17	689.00		-0.87	1825.90	16.00	1.00	15.66	6.20	80.00	19.53	94.00	2.00		-0.30	6.30	0.10	11.20	52.70
3000						1650.00														
3100																				
3200						1660.00														
3300						1560.00														
3400																				
3500						1820.00														
3600						1810.62														
3700	68.30	1.25	610.00		-0.87	1650.66	16.20	1.60	14.60	3.66	76.00	19.06	120.00	2.06	43.60	-0.10	6.20	1.60	11.20	52.30
3800	68.30	1.25	750.00		-0.83	1619.80	16.20	1.60	14.60	6.20	76.00	19.50	125.60							
3900	68.30	1.23	665.00		-0.87	1567.00	16.50	1.65	14.60	6.10	76.00	19.00	128.00	31.20	51.00	0.30	6.10	2.00	11.40	51.50

Test Number	T-2		Run 1		
Temperature	800 Deg F	Heat-up Start	30		
Time	24 Hours	Steady State Start	36	Range #1 436..460	
Date of Test	24-Jul-89	Steady State Stop	60	Range #2 436..460	
		Test End	80	Range #3 436..460	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	BAC-204	PI-202	TIC-204	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWC)	(Deg F)	(Deg F)	(INWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000	60.50	1.35	870.00		-0.06	1812.00	16.00	1.60	14.60	6.40	76.00	19.00	121.00	36.00	46.20	0.30	6.20	1.80	11.70	56.80
4100	60.30	1.30	842.00		-0.04	1817.00	16.00	1.60	14.64	6.40	78.00	19.00	124.00	45.10	35.00	0.10	5.30	2.70	12.30	49.70
4200																				
4300	60.30	1.40	837.00		-0.02	1842.00	16.00	1.80	15.00	6.60	80.00	19.50	110.00	32.00	12.60	0.30	6.40	1.8C	10.90	58.10
4400	31.50	0.87	494.00		-0.06	1882.00			15.20	5.00	80.00	20.00	114.00							74.00
4500	60.00	0.31	90.00		-0.65	1842.00			15.60	5.00	78.00	20.00	114.00		2.00	0.50	5.56	1.60	12.20	74.90
4600	65.00	1.12	60.00		-0.06	1832.00					80.00	20.00	120.00		1.14	0.30	5.80	6.60	12.10	71.30
4700						1800.00								0.60	2.30	0.10	5.40	6.20	12.20	66.00
4800														0.90	1.70	0.10	5.40	5.90	12.30	63.70
4900						1760.00								0.50	1.60	0.10	5.00	5.50	12.40	64.70
5000						1800.00								0.70	1.50	0.10	5.30	5.60	12.50	63.00
5100														0.50	1.70	0.10	5.20	5.80	12.60	60.60
5200						1820.00								0.70	1.00	0.10	5.10	6.03	12.70	53.60
5300														0.63	1.50	0.16	5.10	6.00	12.70	56.00
5400														0.60	1.40	0.10	5.10	6.10	12.70	57.00
5500														0.50	1.50	0.10	5.00	6.20	12.90	55.60
5600														0.36	1.70	0.10	4.90	5.60	13.00	54.20
5700														0.70	1.10	0.10	4.80	6.00	13.10	55.70
5800														0.50	1.40	0.30	4.80	6.70	13.10	54.50
5900														0.30	1.50	0.10	4.90	6.00	13.20	54.30
6000														0.60	1.40	0.10	4.70	7.60	13.30	53.30
6100														0.20	2.10	0.30	4.60	8.90	13.40	52.50
6200														0.50	2.60	0.30	4.60	9.10	13.40	52.60
6300														1.00	2.60	0.60	4.50	8.10	13.30	52.30
6400														0.00	2.90	0.60	4.50	8.00	13.40	53.10
6500														0.60	2.30	0.30	4.50	8.70	13.40	53.80
6600														0.80	2.60	0.20	4.60	8.70	13.40	53.70
6700														1.00	2.40	0.30	4.5	8.90	13.40	54.10
6800														0.50	2.56	0.20	4.50	8.60	13.40	54.00
6900														1.10	2.10	0.10	4.50	8.00	13.30	53.70
7000														0.90	2.30	0.10	4.80	7.00	12.90	55.50
7;30														0.90	2.00	0.10	4.80	7.60	12.90	55.10
7200														0.60	2.00	0.10	4.60	7.90	13.20	52.56
7300														0.40	1.80	0.10	4.70	7.00	13.00	51.70
7400														0.70	1.50	0.10	4.50	7.00	13.30	49.10
7500														0.60	1.54	0.10	4.50	7.30	13.30	51.90
7600														0.60	1.65	0.10	4.63	7.70	13.40	51.60
770.														0.50	1.60	0.10	4.40	7.60	13.40	[illegible]

Test Number	T-8			Run 4		
Temperature		600 Deg F	Heat-up Start	30		
Time		24 Hours	Steady State Start	36	Range #1 436..460
Date of Test	24-Jul-93		Steady State Stop	60	Range #2 430..460
			Test End	80	Range #3 430..460

Elapsed Time (Hours)	Air Heater Inlet Damper Position AIC-201	Air Heater Inlet Air Flow FI-202 (INWC)	Air Heater Temp TIC-204 (Deg F)	After Burner Inlet Temp TI-221 (Deg F)	Building Draft PIC-221 (INWC)	After Burner Exit Temp TIC-324 (Deg F)	Air Heater Gas Pressure PI-203 (PSIG)	Air Heater Burner Pressure PI-310 (PSIG)	After Burner Gas Pressure PI-323 (PSIG)	After Burner Burner Pressure PI-330 (PSIG)
8000										
8100										
8200										
8300										
Steady State Values										
Data Range #1										
Data Pts	17	17	18	1	17	22	17	17	17	17
Total	1142.30	15.21	12245.60	0.00	-1.00	40222.00	274.30	23.50	251.40	104.64
Mean	67.10	1.13	722.65	0.00	-0.06	1828.27	16.14	1.74	14.79	6.33
Maximum	70.00	1.00	811.00	0.00	-0.02	1517.00	16.40	2.00	15.00	6.60
Minimum	63.30	0.82	649.06	0.02	-0.09	1800.00	16.00	1.60	14.60	6.06
Heat-up + Steady State Values										
Data Range #2										
Data Pts	22	22	23	1	22	27	21	21	22	23
Total	1443.30	23.61	16127.00	0.00	-1.23	45418.53	338.70	35.70	321.00	140.10
Mean	65.60	1.07	733.05	0.00	-0.06	1638.00	16.13	1.70	14.73	6.27
Maximum	70.63	1.00	811.00	0.00	-0.02	1517.00	16.40	2.00	15.00	6.60
Minimum	61.30	0.65	645.00	0.25	-0.08	1776.00	16.00	1.40	14.40	6.00
Total Treatment Values										
Data Range #3										
Data Pts	25	25	25	1	25	34	21	21	24	24
Total	1613.30	26.31	15761.00	0.00	-1.48	62146.00	338.70	35.70	354.60	151.70
Mean	64.50	1.05	630.44	0.00	-0.06	1827.82	16.13	1.70	14.78	6.32
Maximum	70.00	1.00	811.00	0.00	-0.02	1917.00	16.40	2.00	15.40	6.60
Minimum	51.60	0.65	40.00	0.00	-0.09	1760.00	16.00	1.00	14.40	5.00

Elapsed Time (Hours)	Propane Tank Temp (Deg F)	Propane Line Pressure (PSIG)	Propane Line Temp (Deg F)	Air Heater Exit THC (ppm/v)	Flash Chamber Exit THC (ppm/v)	After Burner Exit THC (ppm/v)	After Burner Exit CO2 (%)	After Burner Exit CO (ppm/v)	After Burner Exit O2 (%)	After Burner Exit NOX (ppm/v)
8000				0.40	1.50	0.10	4.49	7.40	13.46	49.30
8100				0.60	1.40	0.10	4.4[illegible]	7.60	13.50	50.06
8200				0.40	1.20	0.10	4.40	7.70	13.50	50.26
8300				0.20	1.20	0.10	4.40	7.50	13.50	45.84
Steady State Values										
Data Range #1										
Data Pts	17	17	17	14	12	15	16	15	15	15
Total	1344.00	323.50	1507.00	446.60	374.90	0.60	55.75	1.00	235.00	824.10
Mean	76.18	19.30	112.18	31.86	31.24	0.03	5.56	0.65	11.00	54.94
Maximum	82.00	19.50	125.00	46.50	51.00	0.60	7.60	2.70	12.35	68.70
Minimum	76.63	19.00	94.00	2.00	0.00	-0.30	0.00	-0.00	9.60	40.60
Heat-up + Steady State Values										
Data Range #2										
Data Pts	21	22	22	17	17	20	21	20	20	20
Total	1646.00	425.50	2538.60	538.10	456.30	0.00	131.94	16.96	213.50	1108.98
Mean	78.38	19.34	115.41	31.65	25.22	0.00	6.28	0.85	10.68	55.45
Maximum	82.00	19.50	132.00	46.50	51.00	0.60	7.60	2.78	12.30	58.78
Minimum	70.00	19.00	57.00	2.00	6.00	-0.30	0.00	-0.00	9.00	48.60
Total Treatment Values										
Data Range #3										
Data Pts	24	25	25	43	46	47	48	47	47	48
Total	1864.00	445.50	2887.00	555.00	518.60	5.00	264.30	201.63	562.76	2742.40
Mean	78.50	15.42	115.40	12.91	12.67	0.13	5.51	4.28	11.97	57.13
Maximum	82.00	26.00	132.00	46.50	51.00	0.90	7.60	9.10	13.40	74.00
Minimum	70.00	19.00	94.00	0.00	0.00	-0.30	0.00	-0.00	9.00	40.40

Test Number	T-3		Rev 0	
Temperature	400 Deg F	Heat-up Start	17	
Time	24 Hours	Steady State Start	24	Range 01 424..446
Date of Test	26-Jul-88	Steady State Stop	48	Range 02 417..448
		Test End	80	Range 03 417..480

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Left Wall	Exit Gas	Rail Car	Roof	Front Wall	Shell Support Rack	Powder Box	Middle Bars	Steel Pipe	Steam Heated Riser	Steam Heated Valve	Ship Gun	Clay Pipe	Ship Hose	Clay Pipe
											Surface	Surface			Internal	Internal	Surface	Surface	Internal	Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	183	106	111	117	98	98	93	94	116	98	100	100	110	103	100	105	101	98	105	100
100	204	140	115	116	212	215	206	124	147	136	150	142	117	124	110	105	152	153	105	162
200	261	160	133	120	379	350	340	225	234	212	282	271	171	253	219	163	326	292	232	182
300	375	170	202	146	385	371	360	257	260	232	313	301	159	284	266	216	351	334	280	237
400	361	186	200	150	390	375	368	259	265	236	323	367	204	292	276	228	355	339	280	242
500	380	208	234	168	412	380	381	281	285	249	330	320	222	314	305	261	372	355	316	293
600	406	222	246	181	428	401	375	296	296	256	353	346	235	341	323	296	368	370	335	332
700	416	231	256	180	430	407	402	300	306	263	350	349	242	334	333	310	395	382	345	346
800	420	250	267	204	431	416	301	313	318	268	365	356	251	343	346	332	403	386	368	326
900																				
1000	443	267	282	316	453	431	428	336	332	230	394	380	267	361	364	350	422	405	377	383
1100	438	276	286	333	450	432	406	336	338	307	383	31.	270	363	368	36.	425	417	386	470
1200	446	283	296	330	455	436	424	348	345	309	394	382	267	374	372	420	419	420	391	409
1300	440	280	300	236	453	434	418	364	348	296	400	387	281	372	376	377	438	435	396	406
1400	447	284	304	330	450	438	413	357	352	300	403	301	285	375	382	382	436	422	400	404
1500	446	280	310	244	462	440	427	353	356	306	404	306	250	379	387	387	430	425	402	410
1600	458	284	316	346	466	444	420	361	358	307	414	300	294	383	394	391	443	430	407	414
1700	456	286	317	251	463	443	429	362	362	307	412	309	296	382	393	393	442	433	409	416
1800																				
1900																				
2000																				
2100																				
2200																				
2300																				
2400																				
2500	460	327	336	371	463	443	430	377	373	323	413	409	316	392	403	407	445	432	419	425
2600	461	327	336	374	462	442	422	378	374	321	415	408	317	391	402	407	446	437	418	424
2700	465	330	333	376	466	446	439	364	375	332	421	414	320	394	404	407	450	437	419	425
2800	461	332	340	378	466	446	436	377	376	327	419	413	322	395	405	408	450	434	421	426
2900	465	335	345	382	472	442	430	385	381	331	425	415	325	395	407	410	457	442	424	420
3000																				
3100																				
3200																				
3300	387	304	307	376	383	399	213	301	330	262	263	293	262	311	334	383	3?4	382	359	380
3400																				
3500																				
3600																				
3700																				

13-Jun-90

DATA SHEET 4
PAGE 5 OF 6

Test Number	T-1		Run 1		
Temperature	600 Deg F	Heat-up Start	11		
Time	24 hours	Steady State Start	24	Range #1	421..418
Date of Test	24-Jul-[illegible]	Steady State Stop	48	Range #2	417..415
		Test End	80	Range #3	4[illegible]..423

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Left Wall	Exit Gun	Rail Car	Roof	Front Wall	Shell Support Rack	Powder Box	Middle Wall	Steel Pipe	Steam Heated Riser	Steam Heated Valve	Skip Hose	Clay Pipe	Skip Hose	Clay Pipe
											Surface	Surface			Internal	Internal	Surface	Surface	Internal	Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
4000																				
4100																				
4200																				
4300																				
4400																				
4500																				
4600																				
4700																				
4800																				
4900																				
5000																				
5100																				
5200																				
5300																				
5400																				
5500																				
5600																				
5700																				
5800																				
5900																				
6000																				
6100																				
6200																				
6300																				
6400																				
6500																				
6600																				
6700																				
6800																				
6900																				
7000																				
7100																				
7200																				

Steady State Values
Data Range #1

Data Pts	15	1[illegible]	15	15	15	15	15	15	15	15	15	15	15	15	1[illegible]	15	1[illegible]	15	15	15	832

DATA SHEET 4
PAGE 6 OF 6

Test Number	T 8		Rev 1		
Temperature	400 Deg F	Heat-up Start	11		
Time	36 Hours	Steady State Start	24	Range #1 [illegible]	
Date of Test	24 Jul 89	Steady State Stop	48	Range #2 [illegible]	
		Test End	90	Range #3 [illegible]	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Left Wall	Exit Can	Rail Car	Roof	Front Wall	Shell Support Rack	Powder Box	Middle Wall	Steel Pipe	Steam Heated Riser	Steam Heated Valve	Ship Mine	Clay Pipe	Ship Mine	Clay Pipe	
											Surface	Surface			Internal	Internal	Surface	Surface	Internal	Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Total	6742	4450	4625	3638	6450	6512	6115	5128	5296	4546	6426	5473	4363	5634	5734	5757	6501	6324	5914	6166	[illegible]
Mean	440	237	309	244	457	436	422	355	353	303	402	332	259	376	382	564	433	422	358	411	[illegible]
Maximum	466	336	345	382	472	448	439	385	381	332	425	415	325	355	441	428	[illegible]	442	424	470	[illegible]
Minimum	416	231	256	188	430	407	391	348	306	263	358	345	242	334	333	310	395	342	345	346	[illegible]
Heat-up + Steady State Values																					
Data Range #2																					
Data Pts	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	[illegible]
Total	8866	5646	5566	6466	[illegible]	8146	8462	6864	6940	5964	7837	7666	5664	7343	7333	7137	8514	8265	7635	7660	[illegible]
Mean	400	253	281	226	416	257	385	312	314	271	350	348	255	334	333	324	360	376	347	348	[illegible]
Maximum	466	336	345	382	473	448	439	385	381	332	425	415	325	355	407	428	457	442	424	470	[illegible]
Minimum	103	106	111	116	99	90	93	94	116	90	100	100	110	103	100	105	101	98	105	100	[illegible]
Total Treatment Values																					
Data Range #3																					
Data Pts	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	[illegible]
Total	8353	5639	6173	6944	9443	8639	8785	7151	7236	6226	8160	7559	5492	7660	7667	7520	6410	8547	7994	8640	[illegible]
Mean	464	256	360	215	411	393	378	311	314	271	355	346	256	333	333	327	385	372	348	350	[illegible]
Maximum	466	336	345	382	473	448	439	385	381	332	425	415	325	355	407	428	457	442	424	470	[illegible]
Minimum	103	105	111	116	99	90	93	94	116	90	100	100	110	103	100	105	101	98	105	100	[illegible]

TEST RUN 3
500°F/36 HOURS

(T3)

DATA SHEET 1
PAGE 1 OF 2

Test Run T3 -

Test Duration 36 Hrs

Heat Up Rate

Flash Chamber Temperature 500 °F

Flash Chamber Interior

Date 7/15/83

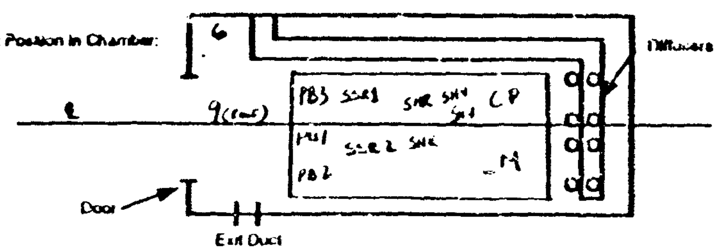
Time

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt (lbs)	Final Wt (lbs)	PAE Sample	TNT Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post Test
1. PB	TNT	[illegible]	10	10			—				handle pushed in, large [illegible]	[illegible], NUMEROUS DENTS
2. PB 1		[illegible]	10	10			10 g				small dent	
3. PB 2		[illegible]	8	8			10 g			10	one large dent	NO LIP
4. SHR 1		[illegible]	11	12			10 g			15 [illegible] 12 [illegible]	[illegible]	
5. SHR 2			11	12			10 g					
6. SR 1		35/15/20	70	68			1 g				Bottom Shelf	Spotted
7. SR 2		35/15/[illegible]	75	75			1 g			8		
8. CP		[illegible]	90	58 [illegible]			—			17	7½" [illegible] Chip	Missing [illegible] of side of [illegible]
9. SM		[illegible]	230	[illegible]			—			16 [illegible] 19 [illegible]		
10. SHV 1		[illegible]	250	[illegible]			10 g					
11. SHV 2		[illegible]	240	[illegible]			12 g			20 [illegible], 18 [illegible]		
12. RT. Side wall										11		
13. FLOOR										13		
14.												
15.												

177 867a

Chain WT. = 7 lbs
Cloth Belt = 2 lbs

Equipment Position in Chamber:



NOTE: Add in chain wt = 7 lbs (SM, SHV1, SHV2)
Add up belt wt = 2 lbs (CP)

* NOTE: SCALE WAS OFF, due to A MISSING LOCK NUT. FINAL WT. MAY NOT BE 100% ACCURATE

DATA SHEET 1
PAGE 2 OF 2

94= - 5407
Jim Reece

belt = 2 lbs

Test Run T3
Test Duration 36 hours
Heat-Up Rate
Flash Chamber Temperature 500°F
Flash Chamber Interior

Date 7/15/89
Time

handle rusted in (hole)

	Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt (lbs)	Final Wt (lbs)	Sample Type Pre	Sample Type Post	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1	PB	TNT	15 11/16" d 11" h	10	10		W	–				Numerous cracks	
2	PB1		15½" d 14" h	10	10	F	4R	10g				sml dent	
3	PB2		13¼" d 13.5" h	8	8	F	R	10g			10	only dent	
4	SHR1		7" w 5" h	11	12	F	(4)R	10g			155 / 12I	Good shape	
5	SHR2			11	12	F	R	10g					
6	SR1		35/15/20	70		W/W	(4)W	1g					
7	SR2		35/15/20	75		W/N	W	1g				burden side scorched	
8	CP		12" d 5½"	90		Sol	S/W/G	–				" "	
9	SM		17¼" L 8½"	730		W/W/W	W/W/W	–			175 / 165	7½" x 10" chr	
10	SHV1		9" d 14.5" h	250		F	R	10g			197		
11	SHV2		5½" d 15.5" h	240		F	R	10g			205 18I	Good shape " "	
12	SR										8		
13	wall outside										11		
14	floor										12		
15	Back surface										4		

no lip

OFF Flange and

diameter of 2 openings 2"

diameter of full opening 10½"

* Chain = 7 lbs

177 657a

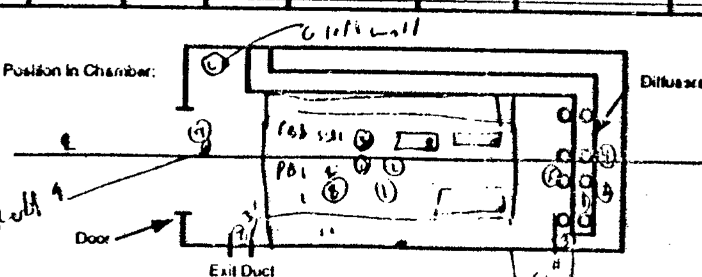
3
5
1
2

Counter weight slats

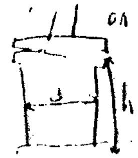
CHAIN WEIGHT = 7 lbs

wall near right diffuser outlet near air

Equipment Position In Chamber:



* Flange to Flange on SHV



DATA SHEET 2
PAGE 1 OF 4

Date 7/16/89 (SUN.) Test Number T3

	Time	Main Panel: Air Heater Inlet Damper HIC-201	Main Panel: Air Heater Inlet Air Flow PI-202 (INWC)	Main Panel: Air Heater Temperature TIC-204 (°F)	Main Panel: T.O. Inlet Air Temperature TI-224 (°F)	Main Panel: Stack Pressure PIC 211 (INWC)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-224 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-208 (PSIG)	Air Preheater: Burner Pressure PI-210 (PSIG)		After-burner: Gas Pressure PI-323 (PSIG)	After-burner: Burner Pressure PI-330 (PSIG)		Propane Tank: Quantity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Air Heater Discharge THC-2 Light off (PPmv)	Flash Chamber Discharge THC-2 Light off (PPmv)	Afterburner Discharge: THC (ppm)	Afterburner Discharge: CO_2 (%)	Afterburner Discharge: CO (ppm)	Afterburner Discharge: O_2 (%)	Afterburner Discharge: NO_x (ppm)
	0000																									
	0100																									
	0200																									
	0300																									
	0400																									
	0500																									
	0600																									
	0700																									
	0800																									
	0900																									
	1000	0																								
1130	1100																			1.0	3.0	1.4	0.5	19.1	13.3	1.8
1	1200	0	0.01	84	107	-0.2	0	492		9.3	0		15	0			70	20.5	98	0.8		1.2	0.8	22.5	8.4	3.7
2	1300	0	-0.12	88	102	-0.22	0	490		9.4	0		15	0			72	21	98	0.8	1.0	0.9	0.9	20.9	16	9.1
3	1400	0	-0.08	91	111	-0.19	0	505	87/65	9.1	0		15	0			72	21	100	0.7		0.7	0.8	20.6	18.2	8.8
4	1500	0	-0.07	94	112	-0.21	0	287					15	0												
5	1600	0	-0.05	97	113	-0.17	0	517		9.	0		15	0			74	21	104		3.0	1.0	0.9	20.5	18	9.2
6	1700	0	-0.08	99	113	-0.20	0	518		8.6	0		14.2	0			76	20.5	102	0.7		1.0	1.3	23.7	17.6	11.6
7	1800	0	0.03	99	114	-0.18	0	783		8.2	0		14.6	6.4			76	20.5	112		2.2	1.1	2.1	27.6	16.7	16.7
8	1900	0	-0.05	99	114	-0.20	0	1011		7.8	0		14.4	3.6			78	20.5	102		1.9	0.5	2.6	23.4	15.7	21.6
9	2000	0	-0.04	91	112	-0.15	0	1220		7.2	0		14.2	6.8			76	20.5	100	1.0	1.7	0	3.2	17.8	15	25.0
10	2100	0	-0.07	94	111	-0.18	0	1421		7.1	0		14.1	1.2			76	20	101		1.5	0.4	4.1	9.7	14	33.2
11	2200	0	-0.08	92	111	-0.14	0	582		6.8	0		13.8	1.9			76	20	108		1.5	0.4	4.1	5.9	15.8	45.1
12	2300	0	-0.06	90	111	-0.23	0	1220	89/62	6.5	0		13.5	2.7			75	20	104		1.5	0.6	5.3	3.4	12.9	50.3

177 0026

To start

= 1 Low ... press ... high ...

BLUE pipe Burner @ -0.2 automatic

1055 hrs. START AFTERBURNER.
1100 - SYSTEM down
1110 - START UP

system down @ 1415 for 15 minutes (low 3D Fans ...)

Jumpered C49 to 3L5.

2345 T.O. temp @ ~1940 °F - went to start A.H. & got low-low bldg press. alarm & shutdown system.

Note: when startup ...

-0.05

18%

DATA SHEET 2
PAGE 2 OF 4

Date 7/17/89 (MON.) Test Number T3

Time	Main Panel: Air Heater Inlet Damper HIC-201	Main Panel: Air Heater Inlet Air Flow PI-202 (in WC)	Main Panel: Air Heater Temperature TIC-204 (°F)	Main Panel: T.O. Inlet Air Temperature TI-224 (°F)	Main Panel: Bag Pressure PIC 221 (in WC)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-224 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air: Gas Pressure PI-303 (PSIG)	Air: Burner Pressure PI-310 (PSIG)	After: Gas Pressure PI-323 (PSIG)	After: Burner Pressure PI-330 (PSIG)	Propane Tank: Capacity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	CEM: Air Heater Discharge THC (ppmv)	CEM: Flush Chamber Discharge THC off (ppmv)	CEM: Afterburner Discharge THC (ppm)	CEM: Afterburner Discharge CO_2 (%)	CEM: Afterburner Discharge CO (ppm)	CEM: Afterburner Discharge O_2 (%)	CEM: Afterburner Discharge NO_x (ppm)
0000	0	-0.05	86	108	-0.50	0	1741		18.4	0	12.7	5.7		75	19.8	101		1.5	1.4	5.6	5.9	14.5	35
0100	2.0	0.17	[illegible]	112	-0.15		[illegible]		16.6	1.2	15.0	7.2		74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.7	[illegible]	[illegible]	[illegible]
0200	40	0.40	890	240	-0.01	-	2032		16.6	1.2	[illegible]	7.5		72	[illegible]	104	[illegible]	19.2	[illegible]	6.2	[illegible]	[illegible]	[illegible]
0300	53.0	0.75	756	290	-0.08	0	1992		16.6	1.3	14.8	7.5		73	19.2	104	27.2	21.3	0.5	6.8	3.2	10.3	50.3
0400	57.9	0.98	704	301	-0.06	0	1950	66/54	16.6	1.3	14.8	7.3		71	19.0	101	31.7	23.3	0.6	6.7	3.6	10.3	53
0500	58	0.84	[illegible]	305	[illegible]	-	[illegible]		16.0	[illegible]	[illegible]	[illegible]		[illegible]	—	—	[illegible]	45.[illegible]	[illegible]	6.[illegible]	[illegible]	[illegible]	[illegible]
0600	62	1.00	880	348	-0.05	0	[illegible]		16.1	[illegible]	14.6	7.3		69	19.2	108	44.6		0.1	5.7	3.7	11.2	55
0700	62	1.01	790	318	-0.06	0	[illegible]		16.4	1.1	14.8	6.8		71	19.0	125	40.1	35.6	0.3	[illegible]	4.0	11.0	[illegible]
0800	58	0.46	950	357	-0.04	0	[illegible]		16.3	[illegible]	14.8	6.8		72	11	[illegible]	46.[illegible]		0.1	[illegible]	4.6	11.0	[illegible]
0900	63	0.78	1097	405	0.04	0	1931		15.6	4.0	[illegible]	[illegible]		70	19	[illegible]	[illegible]		[illegible]	7.[illegible]	[illegible]	[illegible]	[illegible]
1000	60	0.94	1120	433	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	14.6	[illegible]		72	11.1	126	42.0	[illegible]	0.1	6.1	[illegible]	[illegible]	[illegible]
1100	60	0.94	1097	440	[illegible]	0	1970		15.4	3.4	14.6	7.0		70	19.2	126	56.0	36.[illegible]	0.5	6.8	6.0	7.5	[illegible]
1200	66	1.01	1077	452	-0.04	0	2021	93/61	15.6	4.2	14.6	7.0		72	19.2	124	33.9		0.7	6.6	6.6	9.2	57.5
1300	61.5	1.09	1104	463	-0.03	0	1979		15.7	3.8	14.8	7.4		72	19.2	122	CALIBRATION ONGOING						
1400	69.9	1.11	1094	468	-0.06	0	[illegible]		15.8	3.5	14.8	7.2		72	11.5	122		28.8	0.6	7.1	0.6	10.4	56
1500	70.1	1.13	1109	463	-0.04	0	1972		15.6	3.8	15	7.3		74	19.5	126		53.1	0.3	6.7	0.6	11.2	44
1600	69.9	1.10	1029	466	-0.05	0	1882		16.2	3.3	15	7.4		76	20.0	126	34.4		0.4	5.9	0.7	12.1	47
1700	69.9	1.11	990	456	-0.06	0	1923		16	3.0	15	7.5		76	20.0	120	37.0		0.5	6.5	0.6	11.1	50.0
1800	69.9	1.11	972	454	-0.05	0	1925		16.4	2.7	15	7.4		76	20.0	120	37.1		0.4	5.3	0.6	12.2	48.8
1900																							
2000																							
2100	30.1	0.27	1107	350	-0.05	0	2051		16.1	1.9	16.6	1.7		76	20.0	114							
2200	46.1	0.59	1050	400	-0.09	0	2025	85/61	16.4	1.8	15.5	5.0		79	19.4	119	26.4		0.3	7.7	1.8	9.6	47.[illegible]
2300	69.3	1.30	980	459	-0.05	0	1993		16.0	3.4	14.6	6.5		76	19.5	90	54.1	37.9	0.0	6.9	1.9	10.9	48

1515 - Started to decrease A.H. Temp (TIC-304) from 1100

1900 System shut down

2055 - T.O up to 2000°F & A.H. burner start up

0410 - air heater burner out for ~30 sec [illegible]

0645 shut down afterburner [illegible] gas leak

0720 [illegible]

1130 [illegible] think that [illegible]

0105 [illegible]

T.O. [illegible] down to 425 F.

[illegible] Test Begins

DATA SHEET 2
PAGE 3 OF 4

NOTES:

0030 - have been at steady state a total of 12 hrs. Barring any mishaps 36 hr. should be at 2130 on Wed. 7-18-89.

wall sweating [illegible]

1430 STACK TEST #3 begins

Wall continues [illegible]

cool down -- 2206

36 hrs. of Steady State to be at 2130 per Cosmo & Johnson.

Date 7-18-89 (Tues.) Test Number T3

	Time	Main Panel: Air Heater Inlet Air Damper HIC-301	Air Heater Inlet Air Flow PI-302 (INWC)	Air Heater Temperature TIC-304 (°F)	T.O. Inlet Air Temperature TI-324 (°F)	Stag. Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-324 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Burner Pressure PI-310 (PSIG)	Afterburner: Gas Pressure PI-323 (PSIG)	Burner Pressure PI-330 (PSIG)	Propane Tank: Gal (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	CEM: Air Heater Discharge THC (light on) (PPmv)	Flash Chamber Discharge THC (light OFF) (PPmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
37	0000	69.3	1.21	966	446	-0.05	0	1987		16.0	3.2	14.7	6.5		75	19.2	89	58.9	40.3	0.2	6.5	5.0	11.3	44.8
38	0100	69.3	1.20	944	447	-0.05	0	1987		16.0	2.6	14.7	6.5		75	19.2	87	50.7	39.3	0.5	6.8	4.7	[illegible]	45.1
39	0200	69.8	1.20	922	449	-0.07	0	1994		16.0	2.9	14.7	6.5		75	19.8	88	53.1	42.6	0.5	6.7	4.7	10.9	45.7
40	0300	69.3	1.20	926	451	-0.06	0	2008		15.7	3.3	14.7	6.6		74	19.2	86	47.7	47.2	[illegible]	6.8	4.7	[illegible]	45.4
41	0400	69.3	1.20	897	452	-0.05	0	2002		16.0	3.0	14.7	6.4		72	19.2	89	36.3	—	[illegible]	6.1	4.8	[illegible]	[illegible]
42	0500	69.3	1.22	897	452	-0.04	0	1989	64/52	15.8	2.7	14.6	6.5		71	19.2	78	58.6	44.0	0.4	6.0	4.8	12.3	41.7
43	0600	69.3	1.21	898	454	-0.05	0	1986		16.0	2.5	14.6	6.5		71	19.2	76	57.5	41.3	0.5	5.9	4.6	12.1	43.8
44	0700	69.3	1.20	898	454	-0.05	0	1985		15.6	3.2	14.6	6.5		71	19.4	84	51.3	41.4	0.2	5.7	4.7	[illegible]	45.[illegible]
[illegible]	0800	69.5	1.21	902	458	-0.05	0	1988		15.9	2.8	14.4	6.4		71	19.2	85	54.5	41.7	0.1	6.1	4.8	12.1	43.[illegible]
[illegible]	0900															19.1	110							
[illegible]	1000	69.3	1.20	891	457	[illegible]	0	1963		15.4	2.4													
[illegible]	1100	69.3	1.15	898	456	[illegible]	0	1971		16.0	2.5	14.1	6.4		74	[illegible]	125		[illegible]	[illegible]	6.[illegible]	[illegible]	11.8	[illegible]
[illegible]	1200	69.3	1.20	900	455	-0.05	0	1984		16.2	2.3	14.6	6.4		74	19.5	124	41.9		0.2	6.3	6.6	11.5	48.[illegible]
[illegible]	1300	69.3	1.19	892	452	-0.05	0	1978		16.2	2.4	14.6	6.5	[illegible]	76	19.5	122		30.2	0.1	6.2	6.8	11.9	48.3
51	1400	69.3	1.15	896	453	-0.05	0	1979		16.1	1.8	15.0	6.5		76	20	110	25.1		0.3	5.7	1.1	10.1	47.4
52	1500	69.2	1.16	901	461	-0.04	0	1979		16.2	2.4	15.0	6.6		78	20	112		27.4	0.3	6.1	1.2	11.2	46.7
[illegible]	1600	69.2	1.16	886	452	-0.03	0	1996		16.1	2.4	15.9	6.6		78	19.5	118		26.7	0.2	6.0	1.2	11.4	45.3
[illegible]	1700	69.2	1.18	897	459	-0.05	0	2005		16	2.6	15.0	6.7		80	20	118	35.4		0	5.6	0.7	11.[illegible]	48.4
[illegible]	1800	69.2	1.18	904	448	-0.06	0	1934		16	1.9	15.0	6.6		80	20	118	35.1		0.2	5.2	1.1	[illegible]	44.[illegible]
[illegible]	1900	69.2	1.19	892	454	-0.05	0	1946		16.4	2.2	15.0	6.6		80	20	112	35.6		0	5.2	0.3	9.5	[illegible]
[illegible]	2000	69.2	1.15	902	451	-0.07	0	1968		16.4	2.3	15.0	6.7		82	20	102	40.3		0.2	6.1	2.1	11.1	47.4
[illegible]	2100	69.2	1.16	900	457	-0.04	0	1972		16.2	2.3	15.0	6.7		82	19.8	99	45.5	33.1	0.0	6.0	6.7	11.1	[illegible]
2151	~~2200~~	69.2	1.22	920	466	-0.07	0	1990																
2206	~~2400~~	49.1	0.39	375	380	-0.35	0	2052																

2135 - Stack Test 3 ends

2152 → A.H. burner shutdown, leave fan running for cool down
reduce A.H. Inlet damper setting

0830 [illegible]

DATA SHEET 2
PAGE 4 OF 4

Date 7/19/89 Test Number T3 Cooldown

	Time	Main Panel: Air Heater Inlet Damper HC-201	Main Panel: Air Heater Inlet Air Flow PI-202 (INWC)	Main Panel: Air Heater Temperature TC-204 (°F)	Main Panel: T.O. Inlet Air Temperature TI-224 (°F)	Main Panel: Bag Pressure PIC 221 (INWC)	Main Panel: Bleed Air Valve Position HC-22 2	Main Panel: T.O. Temperature TC-224 (°F)	Ambient Conditions; Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		After-burner: Gas Pressure PI-323 (PSIG)	After-burner: Burner Pressure PI-330 (PSIG)		Propane Tank: Quantity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Propane Tank: Air Heater Discharge THC (PPMV)	Propane Tank: Flash Chamber Discharge THC (high off) (PPMV)	Afterburner Discharge: NO (ppm)	Afterburner Discharge: CO_2 (%)	Afterburner Discharge: CO (ppm)	Afterburner Discharge: O_2 (%)	Afterburner Discharge: HC (ppm)
61	0000																									
62	0100																									
63	0200																									
64	0300																									
65	0400																									
66	0500																									
67	0600																									
68	0700																									
69	0800																									
70	0900																									
71	1000	27.1	0.3	89	166	-0.21	0	1826																		
72	1100	27.1	0.5	92	166	-0.16	0	1805					15	6.2						0.3		0	5.8	1.5	[illegible]	[illegible]
73	1200	29.1	0.3	95	163	-0.17	0	1914		18.2	0		15	6.8			76	20	120		1.9	0.1	5.7	1.6	[illegible]	[illegible]
74	1300	29.7	0.3	93	163	-.211	0	2007		18.4	0		15.6	6.1			78	20	120							
	1400																									
	1500																									
	1600																									
	1700																									
	1800																									
	1900																									
	2000																									
	2100																									
	2200																									
	2300																									

(?3)

1320 - Levart site

Channel #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
D?3 Tag	2	3	1	4	5	7	9	8	6	16	13	11	14	15	12	[illegible]	[illegible]	16	20	17										
Equip.	PB							S		S				S	I	I	I	S	S	I										
	Rear [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Door	SSR	Rear wall	PB	Floor	wall	?	SMR	SHR	SHV	CP	SM	SHV2	SM										
0030 - 0	[illegible]4	123	109	120	109	102	126	113	113	109	117	125	111	115	115	117	111	42	117	117										
0130 1	348	132	238	132	326	244	276	177	259	195	152	134	170	136	131	122	153	153	[illegible]	137										
0230 2	468	165	331	148	437	336	339	258	137	244	165	162	224	201	196	167	184	167	[illegible]	310										
0330 3	465	[illegible]	352	162	424	350	350	290	341	278	182	182	263	245	242	214	244	397	245	331										
0430 4	443	209	350	172	416	354	348	296	337	291	192	197	279	268	265	250	277	395	269	346										
0530 5	519	246	399	183	451	406	400	332	382	337	208	215	321	296	292	278	317	462	300	395										
0630 6	539	251	424	198	522	426	416	367	405	361	223	234	351	333	331	316	364	477	355	418										
0730 7	446	254	401	201	469	399	402	345	384	355	221	234	330	323	328	[illegible]	452	454	333	396										
0830 8	546	273	453	213	544	456	450	392	448	390	244	254	381	354	355	348	350	534	367	434										
0930 9	[illegible]	310	515	451	607	515	562	441	495	446	244	481	444	410	465	394	542	555	477	56[illegible]										
1030 10	664	337	535	257	665	526	514	444	513	462	282	295	464	430	436	431	500	597	450	510										
1130 11	673	346	548	271	626	524	528	476	530	474	295	313	473	458	458	460	501	611	474	552										
1230	682	[illegible]	502	292	636	549	537	425	540	491	311	328	425	473	473	482	510	631	493	568										
1330 13	615	396	564	306	631	553	541	494	540	492	317	337	484	481	481	493	513	623	502	564										
1430 14	682	410	569	321	637	553	549	500	549	499	328	346	497	489	488	502	519	628	510	575										
1530 15	618	418	574	325	633	537	547	507	549	504	341	355	501	494	494	510	525	638	515	579										
1630 16	655	421	568	332	617	555	547	503	539	507	330	360	500	494	495	512	524	613	513	567										
1730 17	649	424	560	340	613	542	543	500	537	498	345	364	497	492	492	508	521	622	513	566										
1830 18	650	424	554	344	610	537	535	499	535	495	345	365	494	490	490	508	519	614	510	562										
1930 19	452	304	438	333	453	343	410	417	432	352	322	337	383	442	449	401	476	411	475	450										
2030 missed at 2030 2100 20	456	338	426	295	455	426	435	376	427	358	300	309	382	381	380	415	401	440	408	414										
2130 21	575	344	476	301	549	480	477	411	481	398	309	316	407	396	392	414	411	526	419	460										
2230 22	641	374	552	323	602	527	522	459	518	474	327	335	459	454	428	434	468	596	448	566										
2330 23	640	399	536	337	601	517	518	478	519	478	331	346	475	460	457	458	486	606	471	544										

177 857c

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

DATA SHEET 3

S = SURFACE
I = INTERIOR

Date: 7/18/87
Test: # T3

DZB TH		2	3	1	4	5	7	9	8	6	10	13	11	14	15	12	18	17	16	20	19										
Channel #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.		PB							S		S				S	I	I	I	S	S	I										
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	?	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
0030	[illegible]	641	412	549	348	607	529	535	489	529	501	340	355	481	474	471	475	498	599	484	549										
0130	[illegible]	636	420	546	353	601	523	525	490	525	489	342	361	480	478	479	485	502	606	492	553										
0230	[illegible]	640	425	550	358	606	535	535	495	532	494	349	367	487	484	483	490	507	602	497	555										
0330	[illegible]	638	431	549	364	606	536	535	498	529	500	351	372	491	487	488	496	517	610	502	558										
0430	[illegible]	634	433	552	370	600	538	536	500	530	497	353	374	495	490	488	499	512	601	504	558										
0530	[illegible]	637	437	550	372	605	535	535	499	531	505	355	376	491	491	491	501	513	611	506	560										
0630	[illegible]	636	437	550	374	603	539	540	502	533	502	359	381	492	493	493	501	515	607	507	561										
0730	31	636	441	555	376	601	537	539	502	535	506	361	382	497	494	494	504	514	618	509	564										
0830	32	640	448	555	374	606	542	541	506	536	514	364	385	499	497	496	507	520	611	512	565										
0930	[illegible]	637	447	553	374	544	531	539	504	533	506	368	388	498	498	498	508	522	621	513	569										
1030	31	635	447	554	382	602	539	541	545	535	516	369	389	498	497	497	509	520	604	512	561										
1130	[illegible]	630	446	554	387	548	537	538	502	532	510	366	387	492	495	495	508	519	604	511	558										
1230	31	630	445	552	387	599	536	538	504	532	503	369	388	496	495	495	507	518	603	510	557										
1330	37	630	444	551	387	597	533	535	501	527	503	369	388	494	494	494	507	517	593	509	554										
1430	38																														
1530	31	628	446	447	387	598	530	536	502	513	507	374	389	491	495	494	505	517	602	510	557										
1630	40	629	449	555	391	600	536	538	503	529	505	371	391	495	496	495	507	517	602	510	557										
1730	41	628	449	555	395	602	543	542	541	537	508	373	392	497	496	495	507	517	600	510	557										
1830	[illegible]	629	449	559	400	601	540	543	505	537	505	376	393	496	495	496	508	519	609	510	557										
1930		629	452	550	402	602	545	541	546	533	509	376	395	497	499	498	508	520	604	512	561										
2030		628	455	553	403	600	550	542	508	559	512	377	396	501	497	499	519	521	611	514	563										
2130		631	455	554	405	600	545	541	506	535	510	376	396	497	500	498	510	521	601	513	560										
2230	46																														
2330	47																														

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

1/20/07

	Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		~~PB~~													S	I	I	[illegible]	S	S	I										
		[illegible]	WALL [illegible]	[illegible]	[illegible]	[illegible]	EXIT GAS	ROOF	SSR	LEFT WALL	PB2	FLOOR	WALL [illegible]	2	SHR 1	SHR 1	SHR 2	CP	SM	SHR 2	SM										
0030	49																														
0130	49																														
0230	50																														
0330	51																														
0430	52																														
0530	53																														
0630	54																														
0730	55																														
0830	56																														
0900 ~~0930~~	57	116	159	145	149	128	129	175	141	145	133	148	164	130	139	141	140	138	128	143	132										
1030	58	117	159	146	150	128	130	175	142	140	134	148	164	130	140	141	140	138	128	143	132										
1130																															
1230																															
1330																															
1430																															
1530																															
1630																															
1730																															
1830																															
1930																															
2030																															
2130																															
2230																															
2330																															

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

Test Number	T-3		Run #
Temperature	500 deg F	Heat-up Start	30
Time	36 Hours	Steady State Start	30
Date of Test	15-Jul-88	Steady State Stop	74
		Test End	100

Range #1 430..474
Range #2 430..474
Range #3 430..4100

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOx
	AAC-201	PI-202	TIC-204	TI-224	PIC 221	TIC-224	PI-303	PI-310	PI-323	PI-320										
(hours)		(InWC)	(Deg F)	(Deg F)	(InWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0	0.00	-0.08	84.00	107.00	-0.20	412.00	9.00	0.00	15.00	0.00	78.00	20.50	30.60	0.80		1.20	0.10	20.00	18.10	8.70
100	0.50	-0.12	88.00	109.00	-0.22	490.00	9.40	0.00	15.00	0.60	72.60	21.00	92.00	0.80	1.00	0.90	0.90	20.40	18.00	9.10
200	0.00	-0.08	91.00	111.00	-0.19	565.00	9.40	0.00	15.30	0.00	72.00	21.00	100.00	0.70		0.90	0.80	20.60	18.20	8.80
300	0.00	-0.07	94.00	112.00	-0.21	287.00			15.00	0.00										
400	0.00	-0.05	97.00	113.00	-0.17	517.00	9.00	0.00	15.00	0.00	74.00	21.00	104.00		3.00	1.00	6.40	20.50	18.00	9.30
500	0.00	-0.08	99.00	113.00	-0.20	598.00	8.60	0.00	14.00	0.00	76.00	20.50	102.00	0.70		1.00	1.30	23.70	17.60	11.60
600	0.00	-0.03	99.00	114.00	-0.19	783.00	8.20	0.00	14.60	0.40	76.00	20.50	102.00		2.30	1.10	2.10	24.60	16.10	16.70
700	0.00	-0.05	99.00	114.00	-0.20	1011.00	7.80	0.00	14.40	0.60	76.00	20.50	102.00		1.50	0.56	2.60	23.40	15.70	21.60
800	0.00	-0.06	91.05	112.00	-0.15	1220.00	7.30	0.00	14.20	0.00	76.00	20.50	152.00	1.00	1.70	0.00	3.30	17.00	15.00	25.00
900	0.00	-0.07	94.00	111.00	-0.18	1421.00	7.10	0.00	14.10	1.20	76.50	20.00	101.00		1.50	-0.40	4.10	9.70	14.00	32.20
1000	0.00	-0.06	92.00	111.00	-0.16	1582.00	6.00	0.00	13.00	1.90	76.00	20.00	100.00		1.50	-0.40	4.10	8.00	13.00	40.10
1100	0.00	-0.06	90.00	111.00	-0.25	1780.00	6.50	0.00	13.50	2.70	76.00	20.00	104.00		1.50	-0.60	5.30	3.40	12.40	56.20
1200	0.00	-0.03	86.00	108.00	-0.32	1741.00	10.60	0.00	12.70	5.70	75.00	19.00	104.30		1.50	-0.40	5.60	8.30	16.30	35.00
1300	20.00	0.17	250.00	112.00	-0.15	2045.00	16.60	1.20	15.00	7.20	74.00	19.50	106.00	20.80	14.20	-0.50	7.30	3.30	9.30	44.60
1400	40.00	0.40	250.00	240.00	-0.08	2632.00	16.60	1.20	15.00	7.50	72.00	19.50	108.00	25.50	19.20	-0.30	6.20	3.40	11.30	45.30
1500	53.00	0.75	756.00	290.63	-0.08	1950.00	15.60	1.30	14.00	7.50	73.00	19.20	104.20	29.20	21.30	-0.50	6.00	3.20	10.30	50.30
1600	57.90	0.96	704.30	301.00	-0.08	1950.60	16.60	1.30	14.00	7.50	71.03	19.60	104.00	31.70	23.30	-0.60	6.70	3.60	10.30	53.30
1700	60.00	0.84	612.00	305.00	-0.06	2016.00	16.00	2.00	14.00	7.20				40.00	43.20	-0.50	6.70	3.00	10.10	45.30
1800	63.00	1.00	800.00	348.00	-0.05	2022.00	16.10	2.00	14.60	7.20	68.00	19.20	100.00	44.60		-0.10	5.70	2.70	11.20	55.00
1900	63.00	1.01	790.00	313.00	-0.05	1941.00	16.00	1.90	14.00	6.00	71.00	19.00	125.60	40.10	35.60	-0.30	6.20	4.00	11.62	53.20
2000	68.00	0.86	950.00	351.00	-0.04	1972.00	16.20	2.30	14.00	6.00	72.00	19.90	130.00	45.30		0.30	6.30	4.60	11.00	57.40
2100	63.00	0.96	1017.00	403.00	-0.04	1981.00	15.60	4.00	14.40	6.00	70.00	15.00	130.00	44.90		0.00	7.00	5.00	10.00	101.50
2200	60.00	0.96	1100.00	423.00	-0.04	1981.00	15.60	3.50	14.60	7.00	72.00	19.20	126.00	42.00	34.00	0.10	6.00	5.60	10.70	48.20
2300	60.00	0.94	1037.00	446.09	-0.04	1977.00	15.80	3.40	14.60	7.00	70.00	19.30	126.00	50.00	36.00	0.50	6.00	6.00	9.50	51.00
2400	66.00	1.01	1079.00	452.00	-0.04	2021.00	15.60	4.20	14.60	7.00	72.00	19.20	124.00	33.90		0.90	6.60	6.60	9.20	52.50
2500	63.50	1.00	1109.00	463.00	-0.03	1975.00	15.26	3.00	14.80	7.40	72.00	19.20	122.00							
2600	64.90	1.11	1096.00	468.00	-0.06	1568.00	15.86	3.50	14.80	7.30	72.00	15.50	122.00		28.80	0.60	7.10	0.60	10.40	50.60
2700	90.10	1.13	1185.00	463.50	-0.04	1572.06	15.60	3.00	15.06	7.30	74.00	15.50	126.00		52.30	0.30	6.70	0.60	11.20	48.40
2800	63.90	1.10	1425.00	466.00	-0.05	1342.06	16.20	2.30	15.00	7.40	76.00	23.90	126.00	34.40		0.40	5.90	0.70	12.10	46.90
2900	63.90	1.11	990.00	456.90	-0.06	1913.00	16.00	3.00	15.00	7.50	76.60	20.00	120.00	37.00		0.50	6.50	0.44	11.10	48.00
3000	63.00	1.11	972.00	454.30	-0.05	1835.00	16.30	2.70	15.00	7.40	76.00	20.00	120.00	37.10		0.40	5.30	0.60	12.20	43.00
3100																				
3200	30.10	0.27	1107.00	350.00	-0.05	2037.00	15.60	1.90	16.60	3.30	76.00	20.00	114.00							
3300	46.10	0.60	1650.00	440.00	-0.06	2025.00	16.40	1.90	15.50	5.00	70.00	19.46	119.02	26.40		-0.30	7.10	4.80	9.50	47.10
3400	63.30	1.26	960.00	430.00	-0.05	1993.06	16.00	3.40	14.60	6.50	76.00	19.50	90.09	54.10	37.90	0.00	6.50	4.90	10.40	48.70
3500	63.30	1.25	956.00	405.00	-2.05	1207.00	18.00	3.20	14.70	6.50	75.00	19.20	43.80	58.90	40.30	-0.20	8.50	5.00	11.30	44.20
3600	63.30	1.20	922.00	449.00	-0.07	1994.00	16.00	2.90	14.70	6.50	75.60	19.20	88.00	53.10	42.60	-0.50	6.70	4.70	10.50	45.70
3700	63.30	1.20	925.00	451.00	-0.06	2600.00	15.70	3.30	14.70	6.60	74.00	19.20	86.05	57.70	47.20	-0.50	6.00	4.90	11.00	45.40
3800	63.30	1.20	897.50	452.00	-0.05	2602.00	16.00	3.00	14.80	6.40	74.00	19.20	84.00	56.30		-0.40	6.30	4.80	12.00	43.70
3900	63.30	1.22	897.00	452.00	-0.06	[illegible]	15.80	2.70	14.60	6.50	71.00	19.70	78.00	50.60	44.00	-0.40	6.00	4.00	12.70	42.70

Test Number	T-3		Run 4		
Temperature	500 Deg F	Heat-up Start	38		
Time	36 Hours	Steady State Start	38	Range #1 430..474	
Date of Test	15-Jul-88	Steady State Stop	74	Range #2 430..474	
		Test End	100	Range #3 430..4100	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-201	FI-202	TIC-204	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000	58.20	1.21	890.00	454.00	-0.05	1965.00	16.00	2.50	14.60	6.50	71.00	10.20	76.00	57.50	41.30	-0.50	5.90	4.60	12.10	43.00
4100	60.20	1.20	890.00	454.00	-0.05	1945.00	15.60	3.20	14.60	6.50	71.00	12.40	84.00	54.30	41.40	-0.20	5.70	4.70	12.20	45.20
4200	60.20	1.21	902.20	458.00	-0.06	1978.00	15.90	2.00	14.40	6.40	71.00	19.20	135.00	54.40	41.70	-0.10	6.10	5.00	12.10	42.50
4300												19.20	130.00							
4400	60.20	1.20	801.00	451.00	-0.06	1963.00	15.60	2.00												
4500	60.20	1.10	890.00	456.00	-0.07	1971.00	16.00	2.50	14.60	6.40	74.00	10.00	125.00		33.00	-0.10	6.20	6.30	11.00	46.20
4600	60.20	1.20	900.00	455.00	-0.05	1986.00	16.20	2.30	14.60	6.40	74.03	19.50	124.00	41.90		0.20	6.30	6.60	11.50	48.90
4700	60.20	1.19	852.00	452.00	-0.05	1973.00	16.20	2.60	14.00	6.50	76.00	19.50	122.00		30.20	0.10	6.20	6.00	11.90	48.60
4800	60.20	1.15	896.00	453.00	-0.05	1979.00	16.40	1.00	15.00	6.50	76.00	20.00	110.00			0.30	5.70	1.10	10.70	49.20
4900	60.20	1.16	901.00	461.00	-0.04	1979.00	16.20	2.00	15.00	6.60	78.00	20.00	112.00		27.40	0.30	6.10	1.20	11.30	46.70
5000	60.20	1.16	846.00	458.00	-0.03	1996.00	16.40	2.00	15.00	6.60	78.00	19.50	118.00		26.70	0.20	6.00	1.20	11.40	45.30
5100	60.20	1.18	857.00	453.00	-0.05	2005.00	16.00	2.60	15.00	6.70	80.00	20.00	110.00	35.40		0.00	6.60	0.70	11.00	48.90
5200	60.20	1.10	904.00	448.60	-0.06	1934.00	16.00	1.90	15.00	6.60	80.00	20.00	126.00	35.10		0.20	5.20	1.10	12.40	44.40
5300	60.20	1.19	852.06	454.00	-0.06	1966.00	16.40	2.30	15.00	6.60	60.00	20.00	112.00	35.60		0.00	5.00	0.30	11.50	46.00
5400	60.20	1.16	903.00	457.00	-0.07	1968.00	16.40	2.30	15.00	6.70	82.00	20.00	102.00	49.30		-0.30	6.10	-0.10	11.10	47.00
5500	60.20	1.16	900.30	451.00	-0.04	1973.00	16.20	2.30	15.00	6.70	83.30	19.30	90.00	45.60	33.10	0.00	6.00	5.90	11.10	46.00
5600	60.20	1.22	904.06	466.00	-0.07	1990.00														
5700	30.10	0.34	316.00	220.00	-0.36	2056.00														
5800														0.30	0.10	0.10	5.60	6.10	12.00	60.00
5900														0.20	0.10	0.10	5.60	6.20	12.10	50.30
6000														0.20	0.10	0.10	5.60	6.10	12.60	50.00
6100														0.10	0.10	0.10	5.70	5.00	12.50	58.00
6200														0.19	0.10	0.10	5.79	5.50	12.46	57.90
6300														0.10	0.10	0.10	5.70	5.60	12.50	56.40
6400														0.10	0.10	0.00	1.30	17.00	17.00	12.00
6500														0.20	0.10	0.10	5.06	0.90	13.10	50.40
6600														0.00	0.40	0.20	5.36	7.00	13.00	60.60
6700														0.20	3.50	0.10	5.50	7.70	12.00	63.60
6800	20.10	0.30	80.00	166.00	-0.21	1128.00								0.90	2.10	0.10	5.00	7.60	12.00	67.00
6900	20.10	0.30	82.00	166.00	-0.16	1300.60			15.00	6.20				0.60	3.20	0.10	6.50	7.20	11.70	75.00
7000	20.10	0.30	85.00	163.00	-0.17	1174.00	19.20	0.00	15.00	6.00	95.00	20.00	120.00	11.50	11.90	4.10	6.00	17.60	5.00	96.50
7100	20.10	0.36	90.00	163.00	-0.11	2007.00	18.60	0.00	15.62	6.10	90.00	20.80	120.00	0.90	3.00	0.50	6.20	8.00	11.20	78.10
7200														0.60	2.60	0.20	6.00	8.10	11.20	78.60
7300														1.10	2.70	0.10	6.50	7.60	11.40	77.70
7400														0.30	2.30	0.10	6.50	7.50	11.00	78.00
7500														0.53	3.00	0.10	6.60	7.00	11.30	79.90
7600														1.24	2.10	0.10	6.60	6.00	11.20	76.40
7700																				
7800																				
7900																				

Test Number	T-3		Run 8
Temperature	500 Deg F	Heat-up Start	30
Time	36 Hours	Steady State Start	38	Range #1 438..474
Date of Test	15-Jul-88	Steady State Stop	74	Range #2 430..474
		Test End	100	Range #3 430..4100

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line	Propane Line	Air Heater THC	Flash Chamber THC	After Burner THC	After Burner CO2	After Burner CO	After Burner O2	After Burner NOX
	BIC-201	PI-202	TIC-304	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(InWC)	(Deg F)	(Deg F)	(InWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0000																				
0100																				
0200																				
0300																				
0400																				

Steady State Values
Data Range #1

Data Pts	36	35	36	36	35	35	33	33	32	32	32	33	33	21	19	30	30	30	30	30
Total	2257.36	37.81	33155.00	15617.00	-2.11	65414.00	527.70	92.50	475.60	211.04	2663.00	544.00	3677.00	1044.40	633.60	1.44	185.50	146.00	336.00	1543.30
Mean	65.64	1.08	947.74	446.20	-0.06	1545.54	15.99	2.82	14.86	6.59	75.00	15.52	111.42	41.18	33.56	0.05	6.32	3.53	11.20	51.44
Maximum	70.18	1.22	1109.00	468.00	-0.03	2056.00	16.50	4.30	16.60	7.50	82.00	20.00	135.00	58.90	53.90	0.70	7.70	6.00	12.40	101.50
Minimum	20.18	0.22	37..00	350.00	-0.35	1034.00	15.20	1.00	14.40	3.30	70.00	11.00	76.00	0.00	0.00	-0.50	5.20	-0.10	9.20	42.50

Heat-up + Steady State Values
Data Range #2

Data Pts	43	43	43	43	43	43	41	41	40	40	38	40	40	33	25	30	30	30	32	30
Total	2744.20	43.82	38547.00	17444.00	-2.68	65462.00	658.40	106.00	544.20	268.80	2565.00	778.40	4462.00	1378.60	796.40	-1.10	211.00	125.55	420.50	1551.60
Mean	63.98	1.02	946.67	416.00	-0.06	1547.40	15.06	2.53	14.86	6.72	74.43	19.46	111.55	41.81	31.86	-0.03	6.36	3.57	11.07	51.36
Maximum	90.10	1.22	1105.00	468.00	-0.03	2056.00	16.50	4.30	16.60	7.50	82.00	20.00	135.00	80.00	53.90	0.70	7.70	6.00	12.40	101.50
Minimum	20.00	0.17	255.00	112.65	-0.35	1534.00	15.20	1.30	14.40	3.30	69.00	10.00	76.00	0.00	0.00	-0.60	5.30	-0.50	5.30	41.50

Total Treatment Values
Data Range #3

Data Pts	47	47	47	47	47	47	43	43	43	43	61	42	42	52	44	57	57	57	57	57
Total	3021.60	45.12	39351.00	18566.00	-3.33	83351.00	695.00	106.00	633.80	287.90	3653.00	818.40	4702.00	1402.10	843.80	6.10	348.70	235.50	653.40	3159.30
Mean	64.10	0.96	837.47	394.60	-0.07	1546.15	16.16	2.47	14.84	6.70	74.61	19.49	111.95	26.96	19.16	0.11	6.12	5.13	11.46	56.13
Maximum	90.10	1.22	1105.00	464.00	-0.03	2056.00	18.40	4.30	16.60	7.50	82.00	20.00	135.09	80.00	53.90	4.90	7.70	47.60	17.30	101.50
Minimum	20.00	0.17	80.00	112.00	-0.35	1028.00	15.20	0.00	14.40	3.33	60.00	10.00	76.90	0.00	0.00	-0.60	1.30	-0.10	3.00	12.00

Test Number	T-3		Run 5		
Temperature	500 Deg F	Heat-up Start	17		
Time	76 Hours	Steady State Start	26	Range #1 426..462	
Date of Test	12-Jul-88	Steady State Stop	62	Range #2 411..462	
		Test End	76	Range #3 411..416	

Elapsed Time	Skimmer Support	Rear Wall	Rear Diffuser Support	Rear Floor	Diffuser	Exit Gas	Roof	*Shell Support Back Surface	Left Wall	Powder Box 2	Floor	Middle Wall	Clay Pipe Internal	Steam Heated Riser 1 Surface	Steam Heated Riser Internal	Steam Heated Valve Internal	Clay Pipe Internal	Ship Line Surface	Steam Heated Valve Surface	Ship Line Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	144	123	180	120	140	102	136	113	113	109	117	125	111	115	115	117	111	112	117	117
100	348	132	238	132	336	344	376	119	159	155	138	134	170	136	131	132	153	153	235	137
200	460	165	331	143	437	336	338	258	337	214	165	162	221	201	196	167	184	367	300	310
300	463	182	352	162	439	350	350	290	341	278	182	182	263	245	242	216	441	397	245	337
400	443	209	350	172	416	354	358	296	337	291	192	197	278	268	265	250	277	395	263	346
500	515	236	399	183	481	406	490	332	382	337	200	215	324	296	292	278	317	462	300	395
600	530	251	424	190	503	426	416	367	405	361	223	234	350	333	331	316	364	477	335	410
700	456	250	409	201	463	329	402	345	303	355	221	234	337	323	321	324	352	454	333	396
800	506	273	453	213	544	456	450	392	440	390	244	254	361	358	355	340	390	534	367	459
900	560	310	515	230	607	515	502	444	495	446	268	281	445	410	405	394	542	585	417	512
1000	554	337	535	257	615	526	514	461	513	462	282	295	464	438	436	431	500	597	450	530
1100	573	360	548	270	626	529	528	470	530	474	295	313	472	458	458	460	501	611	476	552
1200	643	362	562	258	636	544	537	485	540	491	311	328	485	473	473	482	510	631	493	568
1300	675	386	564	306	631	553	541	494	540	492	317	337	484	481	481	493	513	623	502	566
1400	652	410	568	321	637	552	540	500	549	499	330	346	497	485	488	502	519	628	510	575
1500	678	418	571	325	633	537	547	507	549	504	334	355	501	494	494	510	525	630	515	579
1600	666	421	568	332	617	555	547	503	530	507	330	360	500	494	495	512	524	613	612	567
1700	640	436	560	340	613	548	543	500	537	498	348	364	497	492	488	500	521	622	513	566
1800	580	424	554	344	610	537	535	499	536	495	345	365	494	490	490	500	618	614	510	562
1900	452	304	430	333	453	343	410	417	132	352	322	337	308	442	449	404	472	611	475	400
2000	466	328	426	206	455	426	426	376	427	356	300	309	382	361	300	415	401	440	408	414
2100	575	346	472	301	540	406	477	411	481	398	309	315	407	396	392	414	423	536	419	460
2200	641	372	532	323	632	521	522	459	510	471	327	336	459	434	428	433	464	596	448	536
2300	640	390	536	337	601	517	518	478	519	478	331	346	475	460	457	458	406	606	471	544
2400	641	412	549	340	607	529	535	467	529	501	340	355	481	474	471	475	498	593	464	549
2500	636	420	546	353	601	523	525	490	525	495	342	361	480	478	479	485	502	606	492	553
2600	640	425	550	358	606	535	535	455	532	494	349	367	487	484	483	490	565	602	481	555
2700	638	434	549	364	606	536	535	450	529	500	361	372	491	487	468	496	517	610	502	558
2800	634	433	552	370	600	538	536	500	530	497	353	374	495	490	488	495	512	601	504	550
2900	637	437	550	372	605	535	535	499	531	505	355	376	491	491	491	501	513	611	506	560
3000	636	430	550	374	603	539	540	502	533	502	359	381	492	493	453	504	515	607	507	561
3100	636	441	555	376	601	537	539	502	535	506	361	382	497	494	494	564	514	610	509	564
3200	640	440	555	379	606	542	541	506	536	514	64	385	499	497	496	507	520	611	512	565
3300	637	447	551	379	539	531	539	504	533	506	368	388	498	498	498	508	522	621	513	569
3400	636	447	552	382	602	539	539	505	535	510	368	388	498	497	497	509	520	604	512	561
3500	630	446	554	387	598	537	538	502	532	510	366	387	492	495	495	508	519	601	511	558
3600	630	445	552	387	599	536	538	504	532	503	369	388	496	495	495	507	518	603	510	557
3700	630	446	551	387	597	533	525	501	527	503	369	388	494	494	494	507	517	553	500	554
3800																				
3900	628	446	440	388	596	538	536	502	533	507	370	389	491	495	494	505	517	602	510	557

Test Number	T-1		Run #	
Temperature	500 Deg F	Heat-up Start	17	
Time	36 Hours	Steady State Start	26	Range #1 426..462
Date of Test	15-Jul-88	Steady State Stop	62	Range #2 417..462
		Test End	76	Range #3 4[illegible]..476

Elapsed Time	Diffuser Support	Rear Wall	Rear Diffuser Support	Rear Floor	Diffuser	Exit Gas	Roof	Shell Support Arch Surface	Left Wall	Powder Box 2	Floor	Middle Wall	Clay Pipe Internal	Steam Heated Riser 1 Surface	Steam Heated Riser Internal	Steam Heated Valve Internal	Clay Pipe Internal	Skip Hine Surface	Steam Heated Valve Surface	Skip Hine Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
4050	625	443	555	357	600	536	538	563	525	565	371	351	455	496	455	507	517	602	510	557
4100	628	443	555	355	632	543	542	564	537	568	373	352	457	496	455	507	517	600	510	557
4250	625	450	555	600	631	540	513	565	537	565	376	353	455	455	456	504	519	609	510	555
4300	636	454	556	603	642	545	541	566	533	580	376	355	457	499	454	504	520	604	512	561
4400	625	455	553	603	643	550	542	566	539	512	377	356	501	457	459	510	521	611	514	563
4500	631	455	544	605	606	545	541	566	535	510	376	356	457	500	458	510	521	608	513	560
4650																				
4700																				
4800																				
4900																				
5000																				
5100																				
5200																				
5300																				
5400																				
5500																				
5650																				
5700	116	158	145	143	128	122	175	141	145	133	140	164	130	138	141	140	138	128	143	132
5800	117	158	146	150	128	138	175	142	146	134	143	164	138	140	141	146	138	128	145	132
5900																				

Steady State Values
Data Range #2

Data Pts	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	0
Total	22143	14364	19438	12623	21518	18870	18338	17541	16666	17521	16006	13638	17316	15177	17155	17555	18218	31160	11165	15537	0
Mean	638	417	560	351	534	527	525	487	525	487	336	362	481	477	477	488	507	556	483	543	[illegible]
Maximum	652	455	571	405	637	555	543	568	543	514	377	396	501	506	459	512	542	638	515	578	[illegible]
Minimum	458	310	426	230	453	343	418	376	437	352	64	201	302	301	340	394	401	411	468	352	[illegible]

Heat-up + Steady State Values
Data Range #3

Data Pts	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	0
Total	26168	16815	22503	14158	25232	22016	23104	20115	21651	20581	13770	11767	13764	19453	19403	19637	20616	24811	20186	22152	0
Mean	536	374	508	315	561	496	481	447	465	456	306	328	435	432	431	438	459	551	449	439	[illegible]

Test Number	T-3		Run 1		
Temperature	500 Deg F	Heat-up Start	17		
Time	36 Hours	Steady State Start	26	Range 1 426..462	
Date of Test	15 Jul 83	Steady State Stop	62	Range 2 417..462	
		Test End	76	Range 3 417..476	

Elapsed Time	Stiffener Support	Rear Wall	Rear Stiffener Support	Rear Floor	Stiffener	Exit Gas	Roof	Saddle Support Back Surface	Left Wall	Power Box 2	Floor	B.Side Wall	Clay Pipe External	Steam Heated Riser 1 Surface	Steam Heated Riser Internal	Steam Heated Valve Internal	Clay Pipe Internal	Ship Wine Surface	Steam Heated Valve Surface	Ship Wine Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Minimum	104	123	109	120	103	102	126	113	113	109	64	125	111	115	115	117	111	112	117	117	888

Total Treatment Values
Data Range 3

Data Pts	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	[illegible]	47	47	47	47	888
Total	23542	17133	22734	14427	25448	22362	22454	20436	22182	20318	14066	15095	20024	19732	15685	[illegible]	[illegible]	25067	20472	22716	888
Mean	573	365	485	304	542	475	478	434	472	433	299	321	426	420	419	425	445	533	436	483	888
Maximum	632	455	571	445	637	555	549	568	549	514	317	336	501	580	455	512	542	638	515	579	888
Minimum	104	123	109	120	103	102	126	113	113	109	64	125	111	115	115	117	111	112	117	117	888

TEST RUN 5
500°F/24 HOURS

FlAzelton 7/25/89

DATA SHEET 1
PAGE 1 OF 2

Test Run TEST T-5
Test Duration 24 hrs
Heat Up Rate
Flash Chamber Temperature 500 °F
Flash Chamber Interior

Date 7/25/89
Time 2310

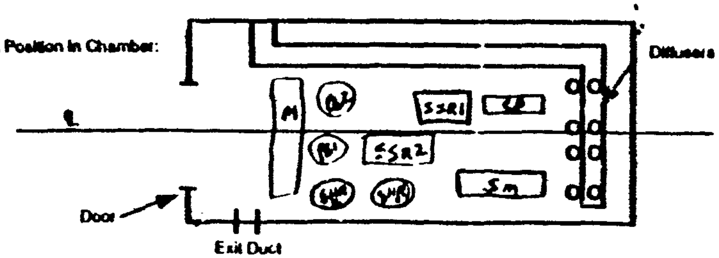
End of TEST T-5 8/2/89

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. PB 1		13" L x 13 H	5	6					12	NO LID. SIDE has DENT SIDE DENTED.	
2. PB 2		x 14" H	8	10							
3. SHR 1		7" x 9" H	11	12					15 I 1:5		
4. SHR 2		7" x 9" H	10	12							
5. SSR 1		15" x 19" x 15	86	86.5					2		
6. SSR 2		25" x 19" x 15	84	85.5							
7. SM			725	722					17 I 16 5		
8. CP			100	95.5					14 I 175		
9. Motor (M)			932	919					9 I 8 5		OIL STAINED
10. Floor									2		
11. Wall									11		
12. Wall									14		
13. Roof									10		
14. left									6		
15.											

- OIL LEAKING OUT OF MOTOR drain PLUG

177 867a

Equipment Position in Chamber:



- SAMPLING TEMPLATE SIZE = 5" x 5"

- POST TEST T-5 MOTOR SOAK — ~~2~~ 104 LITRES of ACETONITRILE placed in 55 gal drum. DRUM HT. = 35" Solvent depth = 24"

Powder Box #1 - No Lip on Top of Box. Lid does not close All The way.

Powder Box #2 - Rounded lip. Larger in Diameter Than PB#1

Steam Heated Riser #1 - Good Shape, Both handles in TACT.

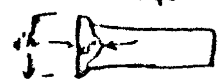
SHR #2 - ORANGE PAINT ON SIDE of Riser. Good Shape.

Shell Support Rack #1 - Larger in size. Several stained areas on bottom of Rack

SSR #2 - smaller in height Than SSR#1. Minimal bottom staining

Steel Pipe - 6 ft. in length. Black Color. Purchased in West Chester, PA.

Clay Pipe - Flange end Broken - 5" x 11½" - Large amt of dirt



3"H x 9" x 37⅝"L of PIPE

Ship Mine - Green in Color. Same as all other ship mines

DATA SHEET 2
PAGE 1 OF 5

Date 28 July 81 Fri. Test Number T-5

Time	Main Panel								Air Preheater			After-burner			Propane Tank				Propane Tank						
	Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Rate FI-202	Air Heater Temperature TIC-204	T.O. Inlet Air Temperature TI-224	Bag Pressure PIC 221	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-324	Ambient Conditions Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Gas Pressure PI-308	Burner Pressure PI-310		Gas Pressure PI-323	Burner Pressure PI 324		Quantity	Tank Temperature	Line Pressure	Line Temperature	Air Heater Discharge THC	Flash Chamber Discharge THC	Afterburner Discharge THC	CO_2	CO	O_2	NO_x
																			ON	off					
	INWC	°F	°F	IN.WC		°F			PSIG	PSIG		PSIG	PSIG		Gal	°F	PSIG	°F	PPmv	PPmv	ppm	%	ppm	%	ppm
0030																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100																									
1200																									
1300																									
1400																									
1500																									
1600																									
1700																									
1800																									
1900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]					[illegible]			[illegible]	[illegible]	[illegible]	[illegible]							
2000	0.0	[illegible]	42	[illegible]	[illegible]	0	[illegible]					[illegible]				83	205	90		1.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2100	[illegible]	[illegible]	41	[illegible]	[illegible]	[illegible]	[illegible]													1.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2200																									
2300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]				[illegible]	[illegible]	[illegible]		1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

DATA SHEET 2
PAGE 2 OF 5

2

Date Saturday 7/29/89 Test Number T-5

	Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202	Air Heater Temperature TC-301	T.O. Inlet Air Temperature TI-324	Stack Pressure PIC 221	Bleed Air Valve Position HIC-22	T.O. Temperature TC-324	Ambient Conditions Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-303	Burner Pressure PI-310		Afterburner: Gas Pressure PI-323	Burner Pressure PI-32C		Propane Tank: Capacity	Tank Temperature	Line Pressure	Line Temperature	Air Heater Discharge THC (ON) (ON)	Flash Chamber Discharge THC (OFF) (OFF)	Afterburner Discharge THC	CO_2	CO	O_2	NO_x
			INWC	°F	°F	INWC		°F		PSIG	PSIG		PSIG	PSIG		Gal	°F	PSIG	°F	PPmv	PPmv	ppm	%	ppm	%	ppm
24	0000	0	-0.0	38	-0.0	-0.15	C	510		0	0		18.0	0.2			78	20	86	0.4		1	1.3	16.5	16	7.2
	0100	0	0.09	36	-0.03	-2.16	0	712		0	0		18.6	0.5			78	20	82		1.1	1.2	1.7	5.2	13	6.5
2x	0200	0	0.04	35	-0.4	-0.13	0	718		●	0		18.2	0.5			76	20	96	1.2		0.4	2.1	18.7	16	5.0
	0300	0	[illegible]	34	0.6	-0.15	0	1110		0	0		18	0.5			74	20	100	0.4		0.9	2.6	13.3	16	18.3
2	0400	0	0.28	33	-0.21	-0.15	0	1107		0	0		18	0.8			74	20	108	0.3		0.4	3.1	14.3	15.4	22.2
	0500	0	0.05	31	-0.21	-0.15	0	1201		0	0		16	2.5			72	20	116	0.3		2.2	7.0	4.1	14.6	28.3
3	0600	0	-0.31	29	-0.16	-0.15	0	1505	66/55	0	0		16.2	2.9			70	20	114	0.4		2.2	2.3	30	15.4	25.6
	0700	0	0.9	27	0.24	0.05	0	1673		0	0		17.6	1.3			70	20	130	0.4		0.0	4.2	0.0	24	39.4
3	0800	0	0.58	26	-0.4	-0.15	0	1171		0	0		15.9	4.8			70	20	130	0.5		0.0	7.5	0.1	10.4	2.2
	0900	0	0.45	24	0.14	0.15	0	1410		0	0		16.0	4.1			72	19	131	(CALIBRATING)						
3	1000	47.3	0.56	284	–	-0.07	0	1267	[illegible]	16	15		14.2	6.7			72	18	130	18.3		[illegible]	6.5	1.0	10.5	49.7
	1100	67.9	0.63	155	229	0.05	0	1335	82/54	16	15		14.9	6.2			72	18	126	37.3		0.5	6.8	0.6	18	55.4
3	1200	65.1	1.09	651	218	-0.06	0	1603		16.2	15		14.4	6.7			72	19	124		25.7	0.3	6.7	0.7	10.3	55.2
	1300	66.1	1.09	670	241	-0.06	0	1644	94/62	16.2	1.5		13.6	6.4			74	20	124	32.1	24.5	0.4	6.6	1.0	10.4	51.2
3	1400	65.1	1.06	658	271	-0.05	0	1844	15/62	16.2	1.5		14.4	6.9			76	19	124	31.0	23.8	0.0	[illegible]	1.0	10.1	[illegible]
	1500	65.1	1.06	541	298	-0.05	0	1526		15.8	2.3		14.6	6.4			76	19	114	33	24.9	0.7	6.4	1.2	10.7	[illegible]
4	1600	65.1	1.08	662	314	-0.09	0	1615		16.0	2.4		14.1	[illegible]			78	17	114	33.0	24.7	0.9	6.5	1.2	10.9	[illegible]
	1700	65.1	1.08	1005	346	-0.0	0	1691		15.6	2.5		14.1	[illegible]			80	19	114	34.0	28.0	0.6	1.1	0.8	9.1	[illegible]
4	1800	71.8	1.18	[illegible]	[illegible]	[illegible]	0	1804		15.8	2.4		15.0	6.5			80	17	112	43.5	[illegible]	0.4	6.1	0.3	11.6	40.5
	1900	71.8	1.20	918	[illegible]	[illegible]	0	1806		16.0	2.7		15.0	6.5			80	17.5	108	[illegible]	21	0.0	6.1	0.3	11.5	[illegible]
4	2000	71.8	1.20	918	359	-0.07	0	1713	90/60	16.0	2.7		15.0	6.5			[illegible]	17.0	110	43.6	[illegible]	1.0	6.1	0.4	[illegible]	50
	2100	71.8	1.19	901	369	-0.06	0	1795		16.0	2.9		15.0	6.3			80	19.5	106	42.6	22.0	0.5	6.3	-0.1	11.3	56.1
X4	2200	71.8	1.20	901	370	-0.07	0	1786		16	2.5		[illegible]	6.0			78	18	66	48.9	34.0	0.4	6.0	2.1	11	[illegible]
	2300	71.8	1.22	901	390	-0.07	0	1808		16.2	2.5		15.2	5.7			76	19	108	45.0	36.8	0.2	6.1	0.3	11.4	[illegible]

0940 - START PREHEATER

1045 Lite off

1730 - Steady STATE

177 86B

3

DATA SHEET 2
PAGE 3 OF 5

Date 7/30/89 SUNDAY Test Number T5

	Time	Main Panel: Air Heater Inlet Damper HIC-301	Main Panel: Air Heater Inlet Air Flow PI-202 (inWC)	Main Panel: Air Heater Temperature TIC-304 (°F)	Main Panel: T.O. Inlet Air Temperature TI-204 (°F)	Main Panel: Bag Pressure PIC-221 (inWC)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-324 (°F)	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Afterburner: Burner Pressure PI-320 (PSIG)		Propane Tank: Capacity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Air Heater Discharge THC (ON) (ppmv)	Flash Chamber Discharge THC (OFF) (ppmv)	Afterburner Discharge THC (ppm)	Afterburner Discharge CO_2 (%)	Afterburner Discharge CO (ppm)	Afterburner Discharge O_2 (%)	Afterburner Discharge NO_x (ppm)
48	0000	71.8	1.20	879	318	-0.06	0.0	1801	74/62	16.2	2.5		15	6.3			76	19	120	62.2	40.5	0.1	6.1	0.7	[illegible]	[illegible]
	0100	71.[illegible]	1.21	902	392	-0.04	0	1802		15.4	3.7		15.2	5.8			76	19	118		50.6	0.1	6.3	0.9	10.9	[illegible]
	0200	[illegible]	[illegible]	[illegible]																						
	0300							1800																		
	0400							1530																		
	0500																									
	0600							1800																		
	0700							1820																		
	0800																									
	0900							1180																		
	1000							1160																		
5	1100	67.4	1.15	865	429	-0.05	0	1801		16	2.2		15.6	5.8			70	19	125	0.2	34.6	0.1	6.0	0.2	11.2	53.1
6	1200	67.4	1.15	565	425	-0.07	0	1798	86/59	15.8	1.7		15.2	5.3			71	19	127	→ IN	CALIBRATION					
	1300	68.4	1.12	874	418	-0.06	0	1797	87/62	15.1	2.9		15.0	5.7			72	19	120	49.9	[illegible]	0.5	6.1	0.9	11.2	51.6
6	1400	69.4	1.17	869	415	-0.05	0	1801		16.2	2.4		15.0	5.4			71	19	126	45.2	[illegible]	0.4	6.0	1.0	11.3	53.3
	1500	68.3	1.13	856	415	-0.09	0	1801		16.2	2.6		15.2	5.9			75	19	126	46.2	34.2	0.4	6.1	1.1	11.3	51.0
6	1600	68.4	1.13	862	414	-0.07	0	1810	99/65	16.2	2.5		15.4	5.5			76	19	122	50.2		0.4	6.0	0.8	11.4	50.8
	1700	66.4	1.15	870	415	-0.07	0	1800	95/67	15.6	3.0		15.2	5.8			78	19	112	46.4	44.0	0.5	6.2	0.7	11.3	50.3
6	1800	66.4	1.12	201	322	-0.09	0	1786		15.2	0		15.2	5.4			78	20	122	← IN	CALIBRATION					
	1900	66.4	1.23	56	226	-0.11	0	1782		17.2	0		15.2	6.6			80	20	120		1.6	0.2	5.3	0.2	12.2	55.4
65	2000	68.4	1.26	41	162	-0.11	0	1741	91/56	17.0	0		15.0	7.2				20	123		14	0.0	5.4	0.4	12.3	[illegible]
	2100							1110																		
10	2200																									
	2300							1740																		

0130 - END STACK TEST 2

STACK TEST #3 begins AT 1215 hrs

1715 - STACK TEST #3 COMPLETE.

1730 - End T-5 Begin COOL DOWN

WAS WORKING

7/31/89 AFTERBURNER shut down @ 0130 hrs. Moylan on site @ 0245 hrs TO ATTEMPT A RESTART of T.O. SYSTEM WOULD NOT START.
- 0940, 7/31/89 - afterburner system running

T5

AfterBurner RE-LIT AT 940AM After switching igniters

Monday
Date 7/31/89 Test Number T5 (Cool Down)

Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow PI-202	Air Heater Temperature TIC-304 °F	T.O. Inlet Air Temperature TI-224 °F	Stag. Pressure PIC 221 INWC	Bleed Air Valve Position HIC-27	T.O. Temperature TIC-324 °F	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-301 PSIG	Burner Pressure PI-310 PSIG
0000										
0100										
0200										
0300										
0400										
0500										
0600										
0700										
0800										
0900										
1000	-0.01	-0.09	31	113	-0.13	0	[illegible]	55/57	17	0
1100	-0.01	[illegible]	41	112	-0.11	0	516			
1200										
1300										
1400										
1500	-0.1	-0.12	44	107	-0.11	0	[illegible]	77/62	17.4	0
1600	-0.1	-0.03	75	105	-0.13	0	[illegible]		—	—
1700	0.1	0.05	54	104	-0.11	0	[illegible]		—	—
1800	-0.1	-0.05	56	103	-0.13	0	1131		—	—
1900	-0.1	-0.01	57	103	-0.13	0	[illegible]		—	—
2000	-0.1	-0.05	58	91	-0.15	0	1144		—	—
2100	349	0.38	42	97	-0.17	0	1241	82/55	—	—
2200										
2300										

Time	After-burner: Gas Pressure PI-323 PSIG	Burner Pressure PI-330 PSIG	Propane Tank: Capacity Gal	Tank Temperature °F	Line Pressure PSIG	Line Temperature °F	Air Heater Discharge THC PPmv	Flash Chamber Discharge THC PPmv	Afterburner Discharge: THC ppm	CO_2 %	CO ppm	O_2 %	NO_x ppm
0000													
0100													
0200													
0300													
0400													
0500													
0600													
0700													
0800													
0900													
1000	124	0	102	68	20	42	0.5	0.5	1.0	1.0	13	[illegible]	75
1100	140	0		70	20	88	0.5	0.5	0.9	1.1	14.7	[illegible]	4.0
1200													
1300													
1400													
1500	18.8	0.3		78	20	102	0.7	0.7	1.1	1.5	144	17.7	[illegible]
1600	17.4	0.5		76	20	108	1.0		1.7	2.1	[illegible]	[illegible]	[illegible]
1700	10.6	0.6		78	20	113		1.4	0.7	2.9	11.4	[illegible]	21.7
1800	18	1.0		78	[illegible]	[illegible]	0.5		0.3	3.3	10.7	[illegible]	[illegible]
1900	[illegible]	1.0		80	20	[illegible]	0.5		0.1	4.0	1.2	[illegible]	[illegible]
2000	16.8	2.7		80	20	112	0.5		0.0	4.1	0.2	14.1	124
2100	143	6.9		80	19	108	0.4		0.1	[illegible]	0.3	13.3	57.0
2200													
2300													

1100 T.O AT 500°F
1600 FULL 3HRS.

rec'd 9200gal propane 1200 hrs 7/31/89

Running 1700°F
830 pm
1900°F T.O at
845 pm.

T5

DATA SHEET 2
PAGE 5 OF 5

Date 8/1/89 Test Number T5

Time	Main Panel: Air Heater Inlet Damper HIC-231	Main Panel: Air Heater Inlet Air Flow FI-202 (IN WC)	Main Panel: Air Heater Temperature TIC-304 (°F)	Main Panel: T.O. Inlet Air Temperature TI-204 (°F)	Main Panel: Bag. Pressure PIC 221 (IN WC)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-324 (°F)	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-309 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		After-burner: Gas Pressure PI-322 (PSIG)	After-burner: Burner Pressure PI-330 (PSIG)		Propane Tank: Capacity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Air Heater Discharge THC (PPm/v)	Flash Chamber Discharge THC (PPm/v)	Afterburner Discharge THC (ppm)	Afterburner Discharge CO_2 (%)	Afterburner Discharge CO (ppm)	Afterburner Discharge O_2 (%)	Afterburner Discharge NO_x (ppm)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000	40.3	0.41	21	62	-0.11	0	1524	76/55	—	—		41.9	20			20	19	124		1.2	0.1	4.5	1.4	3.7	—
1100	40.3	0.49	23	64	-0.13	0	1511	76/55	—	—		155	40			70	19	130	—	—	0.3	4.9	2.1	3.4	28
1200	40.3	0.46	25	65	-0.14	0	1511	84/53	—	—		148	20			72	19	128	0.3		0.6	4.6	2.5	3.6	33
1300																									
1400																									
1500																									
1600																									
1700																									
1800																									
1900																									
2000																									
2100																									
2200																									
2300																									

24 Jul 84 [illegible] T-5 [illegible]

DATA SHEET 3
Page 1 of 4

1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	[illegible]							S	I				S		I	S	I	I	S											
	Steel wall T2					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CP	CP	[illegible]										
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
0830																														
0930 0940 [illegible]																														
1030	344	252	257	332	338	303	327	321	312	328	157	249	189	156	180	217	192	184	242	226	E1							1.1	[illegible]	0.0
1130	340	175	181	191	302	326	317	261	270	361	171	283	243	174	238	327	257	242	276	272										
1230	363	199	211	165	379	356	373	291	292	382	198	311	283	191	279	352	293	281	310	304										
1330	382	315	229	176	393	371	383	311	308	373	265	328	305	201	302	317	315	312	327	[illegible]										
1430	411	235	248	198	421	397	414	335	335	430	221	352	327	[illegible]	324	345	321	337	353	311										
1530	443	257	211	210	460	459	449	367	360	454	237	381	357	229	354	418	370	371	[illegible]	[illegible]										
1630	464	213	287	231	418	451	464	[illegible]	376	464	250	388	378	242	335	443	352	381	402	[illegible]										
1730 steady stat	335	302	315	250	505	489	465	413	420	448	270	425	407	260	405	435	426	448	440	430										
1830	504	324	333	264	514	[illegible]	502	442	421	512	210	443	427	276	424	472	476	456	454	451										
1930	505	527	341	275	522	502	507	448	435	510	293	447	452	212	[illegible]	418	449	465	462	459										
2030	517	341	353	227	525	508	505	455	455	520	301	465	442	241	446	565	400	475	464	462										
2130	522	352	363	295	530	510	519	470	457	526	314	460	452	350	449	511	[illegible]	485	479	479										
2230	531	348	375	305	554	527	521	461	468	510	326	478	466	311	463	526	480	497	493	496										
2330	555	315	383	313	542	530	527	485	475	526	534	482	470	317	469	524	489	505	497	497										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

	Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		PB																													
0030		571	371	368	319	552	536	514	480	477	531	341	484	474	324	473	530	472	528	524	541										
0130		541	536	395	324	553	534	538	495	485	550	349	490	481	338	476	538	497	512	527	560										
0230																															
0330		110	70	70	40	110	310	310	345	345	310	465	495	445	465	415	335	700	705	700	700										
0430		110	80	60	40	110	310	310	300	300	300	470	500	500	475	500	710	700	700	710	710										
0530		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	470	504	500	470	500	705	705	705	705	705										
0630		110	60	50	45	40	310	310	300	300	30	470	500	500	470	500	705	705	705	705	705										
0730		110	30	50	48	110	310	310	300	300	310	475	500	500	470	500	705	705	705	705	[illegible]										
0830																															
0930		110	30	80	70	110	30	310	300	300	310	478	500	500	470	500	705	708	705	705	705										
1030		587	452	461	380	571	582	554	[illegible]	532	572	411	532	533	387	532	571	555	568	558	560										
1130		574	441	452	381	580	563	556	533	524	575	406	524	523	482	520	566	541	551	545	545										
1230		575	437	448	381	582	562	544	531	520	566	401	522	519	361	517	564	531	532	541	513										
1330		571	437	456	382	529	520	554	521	521	566	404	522	515	361	515	521	531	547	535	541										
1430		568	435	418	382	576	558	538	525	518	565	403	519	514	380	512	554	532	544	531	531										
1530		566	434	447	383	574	558	549	525	515	562	402	517	512	380	511	557	531	543	535	535										
1630		564	437	447	383	574	558	551	521	512	524	401	518	511	380	511	558	530	542	534	535										
1730		567	431	448	384	576	557	563	525	513	568	402	517	512	381	510	558	539	541	536	536										
1830		341	366	363	370	331	380	147	432	424	406	357	349	345	337	378	363	408	400	311	341										
1930		350	341	319	419	217	354	262	313	341	374	530	507	354	314	358	317	352	351	310	351										
2030																															
2130		55	55	55	55	55	340	340	340	350	350	450	450	450	450	450	450	452	450	452	450										
2230																															
2330		50	50	50	50	50	345	335	345	355	345	445	445	445	445	445	445	445	445	445	445										

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Ship Mine - SM

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Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

7/31/87 T 5

3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
0030																														
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0630																														
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0830																														
0930																														
1030	203	198	213	221	189	[illegible]	179	[illegible]	[illegible]	223	208	[illegible]	202	196	202	208	206	200	204	197										
1130																														
1230																														
1330																														
1430																														
1530	190	187	203	210	179	191	168	194	170	217	194	192	190	184	190	192	193	189	192	186										
1630	186	186	204	206	178	189	167	192	187	215	194	190	187	182	187	193	192	187	190	184										
1730	183	184	198	206	175	186	166	[illegible]	185	212	192	187	185	180	185	191	187	184	187	182										
1830	183	182	196	205	173	189	162	187	183	207	190	185	183	174	183	189	187	183	185	180										
1930	185	183	197	205	174	184	163	186	181	207	188	184	181	177	181	187	165	181	184	178										
2030	178	179	193	201	169	180	160	195	178	204	186	191	179	175	180	190	183	180	182	176										
2130																														
2230																														
2330																														

Key:

Powder Boxes - PB

Shell Support Rack - SSR

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Ship Mine - SM

Steam Heated Riser - SHR

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Steam Heated Discharge Valve - SDV

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
0030																														
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0830																														
0930																														
1030	135	131	151	165	125	127	115	131	129	155	154	126	124	113	123	128	126	129	125	125										
1130	133	130	130	102	124	127	115	130	127	154	154	126	121	112	124	125	128	122	126	125										
1230																														
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2330																														

177 857c

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Powder Boxes - PB

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Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

Test Number	T 4			Run 4	
Temperature	500 Deg F	Heat up Start	33		
Time	16 Hours	Steady State Start	55	Range #1 433 - 461	
Date of Test	26-Jul-??	Steady State Stop	61	Range #2 461 - 461	
		Test End	112	Range #3 432 - 4112	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Burner Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	AIC-301	PI-302	TIC-304	TI-324	PIC 321	TIC-324	PI-303	PI-310	PI-323	PI 330										
(Hours)		(inWC)	(Deg F)	(Deg F)	(inWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0	0.00	-0.05	42.00	18.00	-0.13	300.00			13.40	0.06	66.00	31.00	90.00							
100	0.00	-0.05	42.00	6.00	-0.12	633.00			13.00	0.00	66.00	205.00	90.00		1.60	1.00	1.20	16.60	18.00	9.10
200	0.50	-0.06	41.30	2.00	-0.11	546.00									1.50	1.10	1.30	17.60	18.00	9.30
300																				
400	0.00	-0.06	40.00	-0.01	-0.10	542.00			13.00	0.00	80.00	28.00	90.00		1.70	1.00	1.30	17.60	10.00	9.00
500	0.00	-0.06	36.00	-0.01	-0.15	[illegible]	[illegible]	[illegible]	[illegible]											
600	0.00	-0.05	36.00	-0.03	-0.16	712.60	0.06	6.06	18.60	6.30	76.00	28.00	92.00		1.16	1.20	1.70	18.20	17.30	12.50
700	0.00	-0.09	35.00	-0.04	-0.13	838.00	0.00	6.96	18.20	0.52	76.00	28.00	96.00	1.20		0.40	2.10	18.70	16.60	15.00
800	0.00	0.07	34.00	-0.03	-0.15	950.00	0.00	6.60	12.86	6.55	76.00	20.00	100.60	0.40		0.90	2.60	16.30	16.00	18.30
900	0.00	-0.06	33.00	-0.02	-0.15	1167.00	0.00	6.06	18.00	6.30	74.00	26.00	104.00	0.30		0.40	3.10	14.40	15.40	22.30
1000	0.00	-0.06	31.00	-0.02	-0.15	1281.00	0.00	0.00	18.30	0.06	72.03	25.00	116.00	0.30		0.00	4.00	4.60	14.10	34.30
1100	0.02	-0.30	25.30	-0.02	-0.15	1564.00	0.00	0.00	16.20	2.90	76.00	28.00	114.00	0.40		0.20	2.70	3.00	15.40	25.60
1200	0.00	-0.05	27.00	-0.02	-0.15	1615.00	0.00	0.00	17.60	1.30	70.50	20.10	130.00	0.40		0.06	4.20	0.00	12.40	59.40
1300	0.00	-0.06	26.00	-0.00	-0.15	1674.00	0.00	0.00	15.60	4.30	76.00	20.00	130.00	0.50		0.30	7.50	-0.10	10.30	76.20
1400	0.50	-0.06	34.50	0.01	-0.15	1578.00	0.00	0.00	15.90	4.10	72.40	13.00	138.00							
1500	47.30	0.56	184.00		-0.07	1467.00	16.00	1.50	14.30	6.70	72.00	10.00	130.60	18.30		0.30	6.50	1.00	10.50	47.70
1600	61.90	0.63	655.00	329.00	-0.06	1835.50	15.00	1.50	14.00	6.70	72.00	10.00	128.00	34.30		0.50	6.00	0.60	9.00	55.00
1700	63.10	1.00	653.00	143.00	-0.06	1843.00	16.79	1.55	14.40	6.70	72.00	10.00	124.00		25.10	0.30	6.70	0.10	10.30	54.30
1800	66.10	1.00	670.00	261.00	-0.05	1844.00	16.20	1.50	14.60	6.00	74.00	20.00	124.00	32.20	24.50	0.00	6.00	1.00	10.40	59.30
1900	65.10	1.05	644.50	211.00	-0.03	1843.00	16.20	1.50	14.60	6.90	76.00	12.00	124.00	31.00	23.00	0.60	6.10	1.00	10.10	62.00
2000	65.10	1.06	841.60	258.00	-0.01	1822.00	15.00	2.30	14.60	6.90	76.00	15.00	124.00	33.60	24.90	0.70	6.40	1.30	10.90	56.60
2100	65.10	1.06	862.00	314.00	-0.05	1815.00	16.30	2.40	14.60	6.90	78.00	13.00	114.00	33.00	28.70	0.90	6.50	1.20	10.40	61.10
2200	65.10	1.08	1065.00	346.00	-0.03	1851.00	15.30	3.50	14.60	7.00	80.00	13.00	111.00	34.00	23.00	0.60	9.10	0.00	9.70	51.00
2300	71.00	1.18	720.00	356.00	-0.07	1844.00	15.06	3.00	15.00	6.50	80.00	13.00	110.60	41.50	340.00	0.40	6.10	0.30	11.20	46.50
2400	71.00	1.26	813.00	360.00	-0.06	1805.00	16.00	2.70	15.05	6.50	80.00	13.50	106.00	37.00	28.00	0.10	6.10	-0.30	11.30	48.50
2500	71.00	1.30	835.00	355.00	-0.04	1733.00	16.00	2.70	15.00	6.50	80.00	13.05	170.60	43.65	30.00	1.00	6.10	-0.40	11.00	50.20
2600	71.00	1.13	561.35	363.50	-0.06	1735.50	16.00	2.30	15.00	6.30	80.50	13.50	106.00	42.60	23.00	0.50	6.30	-0.10	11.30	50.60
2700	71.00	1.20	561.00	370.00	-0.07	1766.00	16.00	2.50	15.00	6.60	72.30	18.00	106.00	48.90	34.00	0.40	6.00	-0.10	11.00	51.20
2800	71.00	1.22	561.00	336.00	-0.07	1600.00	16.20	2.50	15.20	5.70	76.20	13.00	100.00	45.00	36.60	0.30	6.10	-0.30	11.40	48.60
2900	71.00	1.20	675.00	356.00	-0.05	1661.00	16.30	2.50	15.00	6.30	76.00	13.00	100.00	62.20	46.50	0.10	6.20	-0.70	10.90	46.90
3000	71.00	1.21	362.00	353.00	-0.04	1662.00	15.40	3.70	15.20	5.60	76.00	13.00	100.60		50.60	0.10	6.30	-0.30	10.90	45.60
3136																				
3163						1866.00														
3300						1856.00														
3400																				
3435						1850.00														
3600						1856.00														
3700																				
3800						1860.00														

Test Number	T-6		Run 8		
Temperature	550 Deg F	Heat-up Start	32		
Time	24 Hours	Steady State Start	39	Range #1 439..461	
Date of Test	26 Jul 89	Steady State Stop	61	Range #2 432..463	
		Test End	112	Range #3 432..4112	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	AIC 201	FI 202	TIC-204	TI 226	PIC-221	TIC 324	PI-303	PI 310	PI-323	PI-330										
(Hours)		(IWG)	(Deg F)	(Deg F)	(IWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000	50.00	1.15	865.00	425.00	-0.06	1644.00	16.00	2.60	15.20	5.20	70.00	15.00	125.00	0.20	34.60	0.20	6.00	0.20	11.20	52.10
4100	60.60	1.15	865.00	425.00	-0.07	1704.00	15.80	2.70	15.00	5.30	71.50	19.00	127.00							
4200	55.00	1.12	875.00	418.00	-0.06	1757.60	15.40	2.90	15.00	5.70	72.00	19.00	128.00	49.90		0.50	6.10	0.90	11.22	51.60
4300	53.00	1.14	863.00	415.00	-0.05	1649.30	16.20	2.40	15.90	5.90	74.00	19.00	126.00	45.20		0.60	6.00	1.00	11.30	51.56
4400	55.20	1.13	856.00	415.00	-0.09	1641.00	16.00	2.60	15.20	5.90	73.00	19.00	126.00	46.20	31.32	0.60	6.10	7.10	11.30	51.00
4500	60.00	1.13	862.00	414.00	0.01	1610.00	16.23	2.50	15.40	5.50	75.00	19.00	122.00	50.20		0.60	6.00	0.00	11.00	50.00
4600	60.60	1.16	870.06	415.00	-0.07	1660.00	15.60	3.00	15.20	5.00	70.00	19.00	112.00	46.40	44.90	0.50	6.20	0.70	11.30	50.30
4700	60.00	1.10	301.00	322.00	-0.09	1766.00	18.52	0.00	15.00	5.40	70.00	20.00	122.00							
4800	60.60	1.23	56.00	226.00	-0.11	1732.00	17.20	0.06	15.20	6.60	80.00	20.00	120.00		1.60	0.20	5.20	-0.20	14.20	75.90
4900	60.00	1.25	41.00	132.00	-0.11	1734.00	17.00	0.60	15.00	7.20		20.00	123.00		1.40	0.00	5.40	-0.19	12.20	73.00
5000						1774.00														
5100																				
5200						1740.00														
5300																				
5400																				
5500																				
5600																				
5700																				
5800																				
5900																				
6000																				
6100																				
6200																				
6300	-0.01	-0.09	31.00	113.00	-0.13	406.39	17.00	0.00	18.00	0.60	64.00	23.90	52.00	0.50	0.50	1.00	1.00	13.70	18.40	7.50
6400	-0.01	-0.06	41.00	112.00	-0.11	515.00			19.50	0.00	70.00	24.00	50.00	0.50	0.56	0.50	1.10	14.76	18.20	5.00
6500																				
6600																				
6700																				
6800	-0.10	-0.12	44.00	107.00	-0.11	554.00	17.60	0.00	18.00	0.30	70.00	23.00	152.00	0.70	0.70	1.10	1.50	16.46	17.70	11.60
6900	-0.10	-0.06	45.00	105.00	-0.13				17.40	0.50	71.00	20.00	160.00	1.00		1.70	2.10	18.20	16.70	16.60
7000	-0.10	-0.45	56.00	104.00	-0.11	935.00			18.60	0.60	75.00	20.00	164.00		1.40	0.70	2.90	14.40	15.70	21.70
7100	-0.10	-0.01	56.00	103.00	-0.13	1134.00			18.00	1.00	60.00	20.00	110.60	0.50		0.30	3.30	10.70	15.30	25.00
7200	-0.10	-0.04	57.00	103.00	-0.13	1263.00			18.20	1.00	80.00	20.00	122.00	0.50		0.10	4.00	1.20	13.70	44.00
7300	-0.10	-0.06	60.00	95.00	-0.15	1612.00			16.00	2.10	80.00	10.00	112.00	0.50		0.00	6.10	0.20	14.10	42.40
7400	34.00	6.26	42.00	97.00	-0.11	1791.00			14.00	5.90	80.00	15.06	166.06	0.60		0.15	4.60	5.30	13.30	57.00
7500																				
7600																				
7700																				
7800														0.30	1.30	0.10	4.50	5.60	13.50	55.50
7900														0.60	1.10	0.19	4.60	4.60	12.60	55.56

DATA SHEET 4

Test Number	T-5		Row #	
Temperature	500 Deg F	Heat-up Start	32	
Time	24 Hours	Steady State Start	38	Range #1 #38..#63
Date of Test	25-Jul-88	Steady State Stop	63	Range #2 #31..#63
		Test End	112	Range #3 #32..#112

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	SIC-301	PI-302	TIC-304	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-333										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0000														0.40	1.20	0.30	4.50	4.70	13.50	55.00
0100														0.50	1.30	0.10	4.50	6.60	13.50	56.40
0200														0.40	1.30	0.10	4.50	6.10	13.50	55.30
0300														0.30	1.10	0.10	4.50	5.00	13.50	55.40
0400														0.40	1.10	0.10	4.50	7.70	13.60	33.40
0500														0.00	1.70	0.10	4.50	7.40	13.60	0.26
0600														0.50	1.00	0.10	4.60	9.70	13.00	33.50
0700														1.00	3.40	0.60	4.00	10.35	12.10	80.30
3000	60.30	0.40	21.00	65.00	-0.11	1801.00			14.60	1.00	90.00	15.00	131.00	1.00	3.30	0.00	4.40	0.50	13.70	52.50
3100	60.30	0.40	23.00	64.00	-0.13	1753.00			14.80	1.00	90.00	15.00	130.00	0.50	3.20	0.30	4.40	8.20	13.70	53.00
3200	60.20	0.46	25.00	65.00	-0.14	1784.00			14.80	1.00	12.00	15.00	126.00			0.50	4.60	3.50	13.00	53.30
3300																				
3400																				

Steady State Values
Data Range #1

Data Pts	16	16	16	16	16	22	16	16	16	16	16	16	16	14	13	16	15	16	16	16
Total	1123.20	10.55	14283.00	6271.00	-0.95	39700.00	254.00	44.60	241.00	65.90	1222.00	304.00	1888.00	595.00	725.70	5.00	82.70	9.00	166.60	751.20
Mean	70.20	1.17	893.60	391.94	-0.06	1804.55	15.88	2.79	15.06	5.93	76.38	19.00	118.00	42.56	56.13	0.30	6.10	0.60	11.00	50.08
Maximum	71.00	1.22	1005.00	425.00	-0.03	1291.00	16.20	3.70	15.40	7.00	80.00	19.70	170.00	62.90	340.00	1.00	7.10	7.10	11.40	54.00
Minimum	65.10	1.00	856.00	346.00	-0.00	1786.00	15.20	2.40	14.60	5.30	70.00	18.00	100.00	0.20	0.00	0.10	6.00	-0.90	9.70	45.60

Heat-up + Steady State Values
Data Range #3

Data Pts	23	23	23	22	23	29	23	23	23	23	23	23	23	21	18	22	22	22	22	22
Total	1563.90	25.22	15363.00	7891.00	-1.31	52555.00	365.10	56.80	342.40	113.50	1742.00	436.00	2756.00	777.60	857.30	9.90	138.30	15.30	230.00	1150.00
Mean	68.00	1.10	641.03	358.73	-0.06	1812.58	15.93	2.47	14.89	6.24	75.74	18.96	119.83	37.03	47.63	0.45	6.31	0.72	10.45	52.27
Maximum	71.00	1.32	1005.00	625.00	-0.03	1591.00	16.20	3.70	15.40	7.05	80.00	20.00	170.00	62.20	340.00	1.00	7.10	7.12	11.40	62.00
Minimum	47.33	0.36	655.00	228.60	-0.60	1786.00	15.30	1.50	14.28	5.20	76.00	18.00	100.00	0.06	0.00	0.10	6.00	-0.90	9.50	45.66

Test Number	T-5		Run 6		
Temperature	500 Deg F	Heat-up Start	32		
Time	24 Hours	Steady State Start	33	Range #1 d33..d63	
Date of Test	25-Jul-89	Steady State Stop	63	Range #2 d32..d63	
		Test End	112	Range #3 d32..d112	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure
	HIC-301	PI-302	TIC-304	TI-324	PIC-321	TIC-326	PI-303	PI-310	PI-323	PI-330
(Hours)		(IWC)	(Deg F)	(Deg F)	(IWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)
Total Tracked Values										
Data Range #3										
Data Pts	38	38	38	37	36	46	36	34	38	38
Total	1924.38	30.21	20157.20	9769.00	-3.23	75322.60	453.40	56.83	593.00	196.70
Mean	50.64	0.79	530.45	264.05	-0.09	1637.43	12.59	1.67	15.61	5.18
Maximum	91.00	1.26	1005.00	429.00	-0.63	1851.00	18.20	3.70	19.60	7.26
Minimum	-0.10	-0.12	21.00	64.00	-0.17	0.06	0.00	0.00	14.20	0.00

Elapsed Time	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
(Hours)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
Total Tracked Values										
Data Range #3										
Data Pts	37	38	38	41	36	46	46	46	46	46
Total	2804.06	712.00	4463.60	789.70	886.10	18.90	232.30	192.30	580.50	2164.30
Mean	75.78	19.00	117.45	19.26	24.61	0.41	5.05	4.18	12.62	47.05
Maximum	80.00	20.00	170.00	62.30	340.06	1.70	7.10	10.20	18.40	80.90
Minimum	60.00	10.00	82.00	0.30	0.00	0.00	1.00	-6.00	9.70	0.20

DATA SHEET 4
PAGE 5 OF 7

Test Number	T-5		Run 8		
Temperature	500 Deg F	Heat-up Start	17		
Time	24 Hours	Steady State Start	25	Range #1	425..440
Date of Test	25-Jul-88	Steady State Stop	46	Range #2	417..418
		Test End	89	Range #3	417..483

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Left Wall	Exit Gas	Water External	Water Internal	Roof	Middle Wall Right Side	Powder Box Surface	Steam Heated Riser External	Front Wall Right Side	Steam Heated Riser Internal	Chip Bins Surface	Ship Bins Internal	Clay Pipe Internal	Clay Pipe External	Shell Support Rack Surface
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	316	152	151	132	338	303	327	221	212	338	151	249	163	156	160	237	152	184	212	225
100	340	175	185	144	[illegible]	336	347	251	276	363	171	265	245	174	238	327	254	242	276	272
200	363	190	211	163	376	356	373	291	282	362	196	311	283	191	218	352	293	251	316	304
300	382	215	229	176	393	377	383	311	308	354	305	328	305	201	302	360	315	318	328	323
400	416	235	248	182	425	397	414	335	335	430	320	352	327	213	324	395	336	337	353	346
500	443	257	271	216	460	438	449	369	360	456	237	321	357	225	354	428	370	371	383	380
600	464	273	287	221	476	454	461	390	379	464	350	390	370	242	375	443	392	396	402	400
700	485	302	315	250	505	489	485	423	406	490	270	425	33	262	405	475	426	440	440	436
800	506	320	332	260	519	500	563	442	427	543	306	443	427	276	426	493	442	456	454	451
900	505	327	341	275	[illegible]	502	507	448	435	510	303	447	433	283	438	498	449	465	462	459
1000	517	341	353	287	528	521	505	458	445	520	304	455	442	291	440	503	460	475	458	467
1100	529	352	363	295	533	516	519	470	457	526	314	466	452	300	448	516	469	485	470	479
1200	531	368	375	306	554	527	521	481	468	549	325	478	466	311	453	526	480	497	493	490
1300	536	375	383	313	540	530	527	485	475	528	334	482	470	317	463	524	488	506	497	497
1400	541	379	390	319	552	530	519	450	477	537	341	484	474	324	473	530	492	508	503	504
1500	541	386	386	324	553	534	538	455	485	550	349	490	481	330	476	538	497	512	507	508
1600																				
1700																				
1800																				
1900																				
2000																				
2100																				
2200																				
2300																				
2400	587	450	461	380	551	582	554	542	532	572	616	536	533	387	538	579	555	569	558	560
2500	574	445	452	381	586	563	556	533	524	575	605	524	523	382	520	566	544	551	515	545
2600	576	438	448	381	582	562	549	531	520	566	604	528	518	381	517	562	537	550	541	542
2700	571	438	450	382	579	560	554	528	521	566	604	522	514	381	515	561	534	547	538	541
2800	568	435	448	382	578	558	538	525	518	563	603	519	514	380	512	559	532	544	537	539
2900	566	436	447	383	574	558	549	525	516	562	602	517	512	[illegible]	511	557	531	543	535	535
3000	566	437	447	383	576	559	551	521	512	564	601	518	511	380	511	560	530	542	534	525
3100	567	434	440	384	578	561	563	525	513	560	602	517	512	381	510	558	525	541	536	536
3200	301	366	383	376	330	300	297	432	428	606	357	369	395	337	324	363	336	400	351	321
3300	360	334	340	340	297	334	262	393	301	374	330	327	337	314	330	347	352	339	340	339
3400																				
3500																				
3600																				
3700																				
3800																				

Test Number T-5 Rev 0
Temperature 500 Deg F Heat-up Start 17
Time 24 Hours Steady State Start 25 Range #1 425...43
Date of Test 25-Jul-89 Steady State Stop 48 Range #2 417...443
Test End 89 Range #3 417...469

Elapsed Time	Diffuser Support	Rear Front	Rear Wall	Flow Right Side	Diffuser	Left Wall	Exit Gas	Motor External	Motor Internal	Roof	Middle Wall Right Side	Pressure Box Surface	Steam Heated Floor External	Front Wall Right Side	Steam Heated Riser Internal	Ship Mine Surface	Ship Mine Internal	Clay Pipe Internal	Clay Pipe External	Shell Support Back Surface
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
4000																				
4130																				
4260																				
4303																				
4405																				
4535																				
4630																				
4700																				
4800	203	150	213	221	189	20?	179	230	204	233	208	205	202	196	203	208	206	290	204	197
4790																				
5000																				
5130																				
5253																				
5300	180	187	203	210	170	191	188	194	190	217	186	188	190	184	150	186	193	180	182	186
5400	166	186	201	?20	176	183	167	192	187	216	184	190	187	182	187	183	19?	187	150	184
5560	183	184	190	206	175	186	166	180	164	?12	185	187	185	180	186	181	180	184	187	182
5640	183	168	195	206	173	184	162	187	183	200	190	185	183	179	183	180	187	183	185	180
5700	166	1?5	197	206	174	184	163	186	185	207	180	184	181	177	181	187	186	18?	184	178
5850	180	179	183	201	163	180	160	183	178	204	166	181	?79	17?	180	186	?23	180	182	176
5900																				
6300																				
6100																				
6200																				
6300																				
6400																				
6500																				
6600																				
6700																				
6863																				
6900																				
7000																				
7130	136	130	161	163	125	127	115	131	128	156	154	136	134	143	133	126	126	128	125	1?5
7260	133	138	150	162	126	127	115	130	127	154	156	126	124	142	124	125	128	122	126	125

Steady State Values
Data Range #1

Data Pts	18	16	15	16	16	16	16	16	16	16	16	16	15	16	16	[illegible]	16	16	16	16	0

Test Number	T-5		Run 8	
Temperature	500 Deg F	Heat-up Start	17	
Time	24 Hours	Steady State Start	25	Range #1 425..448
Date of Test	25-Jul-86	Steady State Stop	48	Range #2 417..448
		Test End	88	Range #3 417..489

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Left Wall	Exit Gas	Motor External	Motor Internal	Roof
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
Total	8756	6279	6532	5412	8554	8644	8552	3608	7834	8160
Mean	548	332	408	340	568	540	535	520	485	548
Maximum	637	450	461	384	581	562	563	543	532	575
Minimum	384	306	333	268	518	508	502	442	427	516
Heat-up + Steady State Values										
Data Range #2										
Data Pts	24	24	24	24	24	24	24	24	24	24
Total	11975	8007	6425	6842	14234	11791	11734	10601	13415	12602
Mean	499	331	321	289	512	491	451	442	434	563
Maximum	587	450	461	384	581	582	563	542	532	576
Minimum	314	152	151	132	338	303	371	221	345	318
Total Treatment Values										
Data Range #3										
Data Pts	36	36	35	36	36	35	36	35	36	36
Total	14252	10363	10050	9463	14416	14077	13748	13626	13793	14668
Mean	408	296	310	270	412	402	393	372	366	410
Maximum	587	450	461	384	581	582	563	542	532	575
Minimum	133	130	150	122	124	127	115	130	127	154

Elapsed Time	Middle Wall Right Side	Powder Box Surface	Steam Heated Riser External	Front Wall Right Side	Steam Heated Riser Internal	Ship Hine Surface	Ship Hine Internal	Clay Pipe Internal	Clay Pipe External	Shell Support Rack Surface	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Total	5772	7588	7764	5433	7150	8636	8067	8288	6187	8156	0
Mean	361	495	487	343	484	548	524	518	512	512	ERR
Maximum	411	536	533	387	530	575	555	563	558	560	ERR
Minimum	306	443	427	276	454	492	442	456	454	451	ERR
Heat-up + Steady State Values											
Data Range #2											
Data Pts	24	24	24	24	24	24	24	24	24	24	0
Total	7461	10649	6899	7149	10287	11523	10645	10860	10921	10873	0
Mean	312	444	412	234	425	488	444	453	455	453	ERR
Maximum	411	536	533	387	530	579	555	560	555	560	ERR
Minimum	151	249	32	166	164	281	158	164	248	126	ERR
Total Treatment Values											
Data Range #3											
Data Pts	36	36	35	36	35	36	36	35	35	36	2
Total	8630	13321	13106	8358	12458	14003	12596	13153	13227	13136	0
Mean	301	369	340	267	357	440	371	376	378	375	0
Maximum	411	536	533	387	530	579	555	560	558	560	0
Minimum	151	125	32	112	123	145	130	122	125	125	0

TEST RUN 8
400°F/36 HOURS

DATA SHEET 1
PAGE 1 OF 1

Test Run T-B
Test Duration 36 Hrs
Heat-Up Rate
Flash Chamber Temperature 400°F
Flash Chamber Interior

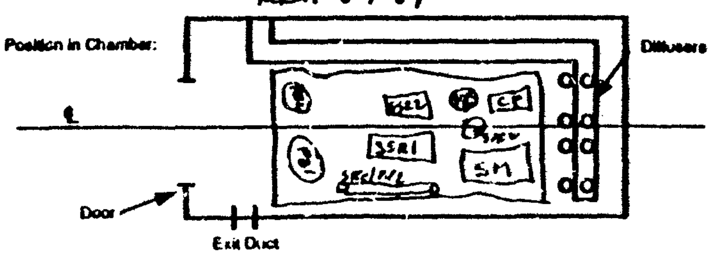
Date 8/3/89
Time

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt. (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. SHR 1		9¼ H x 7	12	11.5[1]							
2. SHR 2		9¼" H x 7	12.5	11.5[1]					10(1) 15(1)		
3. PB 1		[illegible]	8	8.5[1]							
4. PB 2		[illegible]	[illegible]5	10.5[1]					10		
5. SSR 1		[illegible] 15	71	70.5[1]					11		
6. SSR 2		[illegible]	85.5	85.0							
7. [illegible]		24" x 72	20.5	20.5					6		
8. SHIP [illegible]		33" x 27 [illegible]	719	719					13(1) 14(1)		
9.		[illegible]									
10. CLAY PIPE		[illegible] x 12 [illegible] x 14 [illegible]	141	119.5					20(1) 16(1)		
11.											
12.											
13.											
14.											
15.											

177 86.7a

Taken 8-9-89

Equipment Position in Chamber:



NOTES: (1) All Equipment Weighed on SCALE PROVIDED BY DZB

(2) ~~All~~ SSR Spiked w/ 4" x 4" Template

204.5
85.0
119.5

(1)

DATA SHEET 2
PAGE 1 OF 6

Date 3 AUG. 89 Test Number T8 400°F/36 hrs

Time	Main Panel: Air Heater Inlet Damper HC-281	Air Heater Inlet Air Flow PL-282 (IN WC)	Air Heater Temperature TC-284 (°F)	T.O. Inlet Air Temperature TI-284 (°F)	Bag Pressure PI-321 (INWC)	Bleed Air Valve Position HC-22	T.O. Temperature TC-301 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature	Air Preheater: Gas Pressure PL-308 (PSIG)	Burner Pressure PL-310 (PSIG)		Afterburner: Gas Pressure PL-323 (PSIG)	Burner Pressure PL-320 (PSIG)		Propane Tank: Content (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (ON) (PPmv)	Flash Chamber Discharge THC (OFF) (PPmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100																									
1200	0.1	-0.02	50	51	-0.16	0	302	82/55	–	–		18.8	0.2		61	70	22	96		2.4	1.1	1.3	22	16.1	8.1
1300	-0.01	-0.2	32	51	-0.17	0	184		–	–		18.6	0.3			70	20	100		1.9	12	6.4	178	17.1	9.6
1400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		–	–						[illegible]	[illegible]	[illegible]			[illegible]				
1500	-0.1	-0.07	35	53	-0.15	0	516	68/62	–	–		[illegible]	0.1			72	20	98		1.5	1.3	1.2	16.8	16.1	8.4
1600	0	-0.07	39	54	-0.15	0	507		–	–		18.8	0.2			74	20	100		1.4	1.1	1.3	4.5	18	9.2
1700	0	-0.05	41	55	-0.15	0	662	90/66	–	–		18.8	0.3			74	20	100	0.6		1.4	1.6	18.4	17.6	12.1
1800	0	-0.04	41	56	-0.15	0	803		–	–		18.4	0.5			74	20	102		1.5	2.0	2.0	9.8	16.9	14.0
1900	0	-0.04	40	56	-0.15	0	977		–	–		17.6	1.0			75	20	104	0.5		0.7	3.2	18.0	15.3	21.3
2000	0	-0.04	38	55	-0.15	0	1199		–	–		19.2	0.9			74	20	102		1.1	0.2	3.4	13.1	15.1	22.9
2100	0	-0.03	36	55	-0.15	0	1410	82/65	–	–		16.8	2.2			74	20	110		-	0.1	4.4	2.2	13.3	41.1
2200	0	-0.06	35	55	-0.16	0	1573		–	–		17.0	3.4			73	19.5	114	0.4		0	3.7	1.5	11.4	54.0
2300	0	-0.04	34	55	-0.16	0	1180		–	–		16.4	3.4			74	19.5	112	0.4	-	0.1	5.7	1.6	11.3	69.5

AFTERBURNER START AT 1200 HRS

1300 - T.O. @ 500°F

2315 HRS - PRE HEATER STARTED. (T.O. TEMP. AT 1860°F)

/RE

TEST ... F.

(2)

DATA SHEET 2
PAGE 2 OF 6

Friday

Date 4 AUG. 89 Test Number T-8 400°F/36 hrs

Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202 (INWC)	Air Heater Temperature TIC-204 (°F)	T.O. Inlet Air Temperature TI-204 (°F)	Stag Pressure PIC-221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-224 (°F)	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-300 (PSIG)	Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Burner Pressure PI-320 (PSIG)		Propane Tank: Capacity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (PPmv)	Flash Chamber Discharge THC (PPmv)	Afterburner Discharge THC	CO_2 (%)	CO	O_2 (%)	NO_x
0000	66.2	1.08	590	189	-0.05	0	1841	76/53	16.6	1.2		44	6.8			74	19	108	33.4	22	0.1	6.7	2.3	10.1	551
0100	66.1	1.07	550	224	-0.05	0	1863		16.1	1.2		46	6.8			72	19	112	28	33.7	0.2	6.8	1.3	9.8	56.8
0200	66.2	1.08	621	241	0.04	0	[illegible]		16.4	1.3		50	6.3			72	19	120	35.6	26.7	0.1	6.9	1.2	9.8	569
0300	70.1	1.27	653	262	-0.04	0	[illegible]	68/54	16.2	1.6		44	6.9			72	19	124	62.0	~45	0.1	6.9	1.1	10.0	571
0400	70.0	1.27	666	283	-0.03	0	[illegible]	65/51	16.2	1.7		46	6.7			70	19	126	60.2	~47	0.0	6.6	1.0	10.3	58[illegible]
0500	70.0	1.27	730	299	-0.04	0	1802		16.0	1.6		46	6.8			70	19	124	54.7	~43	0.1	6.0	0.9	11.4	534
0600	69.9	1.27	720	306	-0.05	0	1823	64/53	15.8	2.1		42	6.9			68	19	134	62.1	~44	0.1	6.4	0.8	10.3	57.3
0700	69.9	1.24	717	312	-0.02	0	[illegible]		15.8	2.0		42	6.6			70	19	124	58.2	~44	0.2	6.5	1.2	10.4	57.3
0800	69.9	1.25	717	324	-0.05	0	1853	70/52	16.4	1.9		44	6.7			68	19	130	55.2	~42	0.0	6.6	0.4	10.5	[illegible]
0900	69.9	1.27	725	330	-0.0[illegible]	0	1855	74/60	16.2	2.0		44	6.9			70	19	134	?	43.7	0.3	6.3	0.4		549
1000																									
1100	69.9	1.26	704	334	-0.05	0	1866	83/59	15.8	1.9		44	6.8			70	19	126	47.3	35	0.1	6.4	0.2	10.3	[illegible]
1200	69.9	1.25	695	350	-0.05	0	18[illegible]																		
1300																									
1400	69.9	1.26	701	332	-0.0[illegible]	0	1869		15.8	2.0		44.8	6.8			72	19	124	45	32.1	0.1	6.3	0.0	10.4	571
1500							1850																		
1600							1880																		
1700																									
1800							1840																		
1900							1850																		
2000	69.9	1.25	687	344	-0.05	0	1851		16.0	1.6		45.0	6.6												
2100							1845																		
2200							1880																		
2300																									

5:30 AM STEADY STATE ACHIEVED.
← NO_x Jumping at Thermocouple 8 ... 318°
Int. Reset 500°
C.P. Side 700°
8:12 ... 750°
8:14 975°
8:17 1900°

2039 hrs – in to check on system running okay – High building press. alarm going off but nothing shutdown. Looks okay. ~~...~~ exit gas temp high – lowered ... ... holding ...

1000 – Cal Latin from Cal Gas here to check tank 78% full. Wants us to let him or his office know when we are running & doubt ... he doesn't have to come ...

DATA SHEET 2
PAGE 3 OF 6

(3)

Sat.

Date 5 Aug 89 Test Number T8 400° / 36 Hrs

2230 CTY running with settings as follows:
AH in damper 40% Air flow .5 in.
Exit out " 21% Bld press. -.09 - -0.11
T.O. 1650° S.P. (75% run)

Time	Main Panel: Air Heater Heat Damper HIC-201	Main Panel: Air Heater Heat Air Flow PI-317 (in. wc)	Main Panel: Air Heater Temperature (°F)	Main Panel: T.O. Inlet Air Temperature (°F)	Main Panel: Stack Pressure PIT-221 (in. wc)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature (°F)	Ambient Conditions: Dry Bulb / Wet Bulb	Air Preheater: Gas Pressure PI-301 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Afterburner: Burner Pressure PI-330		Propane Tank: Capacity (%)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Air Heater Discharge THC ON (ppmv)	Flash Chamber Discharge THC OFF (ppmv)	Afterburner Discharge THC (ppm)	Afterburner Discharge CO_2 (%)	Afterburner Discharge CO (ppm)	Afterburner Discharge O_2 (%)	Afterburner Discharge NO_x (ppm)
0000							1366																		
0100							1380																		
0200							1460																		
0300							1446																		
0400																									
0500							1310																		
0600							1342																		
0700																									
0800							1835																		
0900	694	1.27	643	364	-0.05	0	1594	79/59	22	7		46	64			20	19	134	5.4	46.2	0.1	6.5	0.55	11	34
1000	699	1.22	574	341	-0.05	0	1598		68	1.2		46	68			20	19	128	41.8	36	0.1	6.1	0.7	11.1	549
1100	694	1.26	561	335	-0.05	0	[illegible]	86/62	66	1.2		44	68			22	19	126	4.5	37.4	0.0	6.1	4.8	11.1	34
1200	691	1.27	572	331	-1.07	0	1565		64	1.3		46	70			22	19	124	44	34.3	0.0	6.3	0.7	11.2	533
1300							1316																		
1400							1326																		
1500							1411																		
1600																									
1700							1510																		
1800	698	1.37	436	302	-1.0	0	1563	93/64	179	0		52	7.4			78	20	118		1.4	0.1	4.5	0.6	13.2	732
1900	661	0.9	64	165	-0.17	0	1280																		
2000																									
2100	550	1.6	28	140	-0.25	0	1530					54	58			76	19	112	0.5	1.0	0.1	4.8	0.2	13.2	[illegible]
2200	46.0	0.5	26	130	-0.10	0	1515					54	64						0.5	1.1	0.1	5.1	10	12.9	529
2300							1510																		

0830 AM
CTY and Paul arrive – exit gas ~480° @ 640 set pt on air heater. Reduced S.P. to 630

Leaving site 12:15 with AH. Set Point of 570

Onsite 1755
Exit gas 416° at 570 S.P.

1755 Stopped fan, reset to end 36 hour run

1835 – T.O. tripped out due to low temp. < 1700°
Dropped to 1070° before purge completed and relighting. Back up to 1735 at 1850. Left

2035 Call from security w/ trip.
2050 CTY onsite High Blr Press., Low Temp., Flame Failure lights on. T.O. temp 300°

④

DATA SHEET 2
PAGE 4 OF 6

Sunday

Date 6 AUG 1989 Test Number TB 400° / 36 hrs

Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202 (INWC)	Air Heater Temperature TIC-204 (°F)	T.O. Inlet Air Temperature TI-224 (°F)	Bag Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-224 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-228 (PSIG)	Air Preheater: Burner Pressure PI-210 (PSIG)		After burner: Gas Pressure PI-223 (PSIG)	After burner: Burner Pressure PI-220 (PSIG)		Propane Tank: Capacity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Propane Tank: Air Heater Discharge THC (Light ON) PPmv	Flash Chamber Discharge THC (Light off) PPmv	Afterburner Discharge THC (ppmv)	CO_2 (%)	CO (ppm)	O_2 (%)	KO (ppm)
0000																									
0100							15·																		
0200							1840																		
0300																									
0400							1·																		
0500							1840																		
0600																									
0700							14·																		
0800							18.0																		
0900	40.0	0.49	27	85	-0.14	0	1925		182	0		14.1	7.0			71	19.2	128			0.1	4.9	0	12.9	61.1
1000	40.0	0.51	27	25	-0.14	0	1827																		
1100																									
1200							1840																		
1300			-7				1919																		
1400																									
1500							1958																		
1600			27				1·																		
1700																									
1800							1920 / 1920																		
1900																									
2000																									
2100							1·																		
2200							1810																		
2300																									

09:15 high pitch ringing in gas line. ? Is this normal ?

– no THC reading Paul Calibrating.

(5)

DATA SHEET 2
PAGE 5 OF 6

1241 - power surge, electrical storm approaching, lights flickered and whole system down.
1246 - System up & running

1630 system tripped - due to power surge of thunder storm. Brought up to 1735 at 1640.

Date 7 AUG 89 Monday Test Number 78 400° / 36 hrs

Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Press PI-202 (in WC)	Air Heater Temperature TIC-204 (°F)	T.O. Inlet Air Temperature TI-224 (°F)	Bag Pressure PIC 221 (in WC)	Recirc Air Valve Position HIC-22	T.O. Temperature TIC-224 (°F)	Ambient Conditions Dry Bulb Temperature Wet Bulb Temperature and Moisture Content	Air Heater: Gas Pressure PI-203 (PSI)	Burner Pressure PI-210 (PSI)	After-burner: Gas Pressure PI-323 (PSI)	Burner Pressure PI-324 (PSI)	Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSI)	Line Temperature (°F)	Air Heater Discharge THC ON (PPmv)	Flash Chamber Discharge THC OFF (PPmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000							182																
0100																							
0200	40.0	0.51	23	64	-0.14	0	1826																
0300	40.0	0.51	21	65	0.14	0	1833		15.7	0	11.1	7.0		71	19	127	—	0.9	0.3	4.6	6.6	12.7	36.1
0400	40.0	0.51	18	62	0.14	0	1835		15.5	0	14.6	6.9		71	19	129	0.5	—	0.4	4.8	0.6	11.0	37.6
0500	40.0	0.50	20	61	0.15	0	1832		15.6	0	14.6	6.9		69	19	122	0.4	—	0.1	4.9	0.7	11.1	35.2
0600	40.0	0.50	17	60	0.07	0	1823		15.5	0	14.5	7.0		67	19	121	0.4	0.9	0.2	5.9	7.2	11.5	7.8
0700	40.2	0.52	15	59	0.00	0	1822		15.3	0	14.6	2.0		67	19	120	—	1.0	0.1	6.1	17	12.0	4.7
0800																							
0900	40.0	0.47	25	62	-0.0[illegible]	0	1574	74/66			14.6	6.9		70	17	126	0.5	1.0	0	5.8	12	11.1	20
1000	40.[illegible]	0.47	26	62	-0.02	0	1860																
1100	41.6	.248	21	63	-.0[illegible]	0	1870		21	0	14.3	2.0		71	19	126	0.4	1.0	0.1	5.1	[illegible]	12	68
1200																							
1300	40.0	0.42	33	65	.09	0	1880		16.9	0	14.8	7.5		—	—	—	—	1.5	0.5	6.1	15	10.1	20.4
1400	40.0	0.45	23	61	.06	0	1914		15.8	0	14.7	7.3		71	19.2	117	0.5		0.0	6.2	2.5	11.7	7.5
1500	40.0	0.46	23	61	-.1[illegible]	0	1868	62/46			14.8	2.3		72	19	114	0.5	1.0	0.0	4.9	23	11.5	22
1600																							
1700							1860																
1800																							
1900							1850																
2000							1850																
2100																							
2200							1840																
2300							1860																

0300 - T.O. Temp set pt 1815°. I feel valve at 100% - temp in this & not moving up much.

06.55 - leave site (ygh) RAB

0518 - T.O. burner ignited up & running.

05.26 - T.O. Temp 1743

0139 - ~~Dialer~~ Beeper went off - system down
0203 - RTS on-site. Flame failure, High building press., low temp.
0206 - got T.O. Burner going. T.O. Temp

0515 - ~~Alt~~ Quite as I was getting into the truck to leave I noticed the building lights go out. I thought it strange that the electric eyes would shut off so early (sky

(6)

DATA SHEET 2
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Date 8 Aug 1989 Tuesday Test Number T 8 400°/36 hrs.

Time	Main Panel								Air Preheater			Afterburner			Propane Tank				Propane Tank						
	Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow PI-202	Air Heater Temperature	T.O. Inlet Air Temperature	Bag. Pressure PIC-?21	Bleed Air Valve Position HIC-22	T.O. Temperature	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Gas Pressure PI-303	Burner Pressure PI-310		Gas Pressure PI-323	Burner Pressure PI-330		Capacity	Tank Temperature	Line Pressure	Line Temperature	Air Heater Discharge THC	Flash Chamber Discharge THC	Afterburner Discharge THC	CO_2	CO	O_2	NO_x
		INWC	°F	°F	INWG		°F		PSIG	PSIG		PSIG	PSIG		Gal	°F	PSIG	°F	PPmv	PPmv	ppm	%	ppm	%	ppm
0000																									
0100							1845																		
0200							1850																		
0300																									
0400							1840																		
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100																									
1200																									
1300																									
1400																									
1500																									
1600																									
1700																									
1800																									
1900																									
2000																									
2100																									
2200																									
2300																									

0600 SYSTEM TRIPPED DUE TO POWER SURGE
0625 CTY AND P.S. ONSITE ALL EQUIP < 120°
SO SHUT SYSTEM (T.O. AND AHU) DOWN.

0715 - MOLYTEK FAILED IN POWER OUTAGE

0930-1000 CTY AND R.S. OPENED FLASH CHAMBER
Removed thermo[illegible]

T8 8/3/89 AFTERBURNER IGNITION 12:05 PM

DATA SHEET 3
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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB									S								S		S										
	[illegible]					STEEL PIPE	[illegible]	[illegible]	[illegible]	PB2	SSR1	[illegible]	SM	SM	[illegible]	CP	SB	[illegible]	[illegible]	CP										
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
0830																														
0930																														
1030																														
1130																														
1230	109	43	122	128	106	103	126	49	108	123	103	122	103	106	95	76	109	97	100	92										
1330																														
1430	110	115	122	128	107	105	126	101	110	102	106	122	108	107	102	83	111	103	101	105										
1530	111	115	124	128	108	107	126	102	111	107	108	123	110	108	105	87	112	106	105	103										
1630	112	114	124	128	109	108	126	102	111	108	109	122	112	110	108	89	112	108	107	106										
1730	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓										
1830 6																														
1930 7	113	115	124	129	110	108	126	103	112	109	110	123	113	111	110	92	113	110	108	108										
2030																														
2130																														
2230																														
2330 11	266	124	134	129	289	212	259	268	217	227	255	158	134	265	140	101	258	166	220	166										

Key:
- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

177-357c

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		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Equip.	PB																													
						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	162	SSR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SHR	[illegible]	CP										
0030		306	157	162	142	322	267	296	305	267	264	287	159	206	300	198	132	315	216	257	225										
0130		329	181	187	159	341	294	321	321	269	305	306	178	254	319	237	162	336	218	270	251										
0230		313	194	207	174	355	316	[illegible]	[illegible]	328	328	321	192	280	332	264	166	353	274	268	270										
0330		360	219	228	187	327	343	[illegible]	371	332	267	350	209	309	361	292	203	361	302	340	341										
0430		406	236	247	202	411	368	369	373	353	340	370	222	332	382	316	209	406	324	361	338										
0530		424	252	263	214	429	366	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	229	432	347	379	361										
0630		436	267	279	226	446	372	408	413	385	418	399	200	369	404	355	250	436	361	372	376										
0730		439	277	287	235	446	403	415	416	394	426	410	260	361	410	369	281	445	376	408	389										
0830		449	281	294	242	456	414	424	424	426	438	415	265	390	423	380	[illegible]	452	386	416	198										
~~0930~~		442	295	306	256	452	415	421	425	407	437	418	277	399	423	391	553	451	396	427	435										
1030		—	—	—	—	—	—	—	—	...	...	...	...	...						...											
1130		447	302	311	262	458	422	427	428	409	438	421	221	400	424	394	494	453	398	426	428										
1230	23	450	304	314	266	455	419	424	434	410	439	416	384	402	420	396	483	452	399	421	423										
1330	24	444	307	317	270	456	418	422	429	412	436	418	287	403	424	397	471	453	400	425	421										
1430		456	314	321	274	460	419	424	435	415	437	420	290	405	426	399	459	452	402	429	423										
1530		90	65	65	55	90	290	290	290	290	290	485	460	485	485	485	640	690	685	685	685										
1630		90	65	65	55	90	290	290	290	290	290	485	460	485	485	485	640	690	685	685	685										
1730																			685	685	685										
1830		90	65	65	55	90	240	240	290	290	290	485	460	485	485	455	640	690	685	685	685										
1930		90	65	65	55	90	290	290	290	290	290	485	460	455	485	485	690	690	685	685	685										
~~2030~~ 2045		465	352	343	295	472	455	438	448	432	453	434	311	[illegible]	435	417	444	469	420	447	437										
2130		90	65	65	55	90	290	290	290	290	290	485	460	485	455	455	640	610	685	685	685										
2230		90	65	65	56	90	290	290	290	290	290	485	490	485	485	485	690	690	685	685	685										
2330																															

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

(58) 8 AUG 89 T8 400°/36 hrs

DATA SHEET 3
Page 3 of 6

(3)

	Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		PB																													
							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
0030	3[illegible]	90	65	65	55	90	265	265	265	265	265	463	464	462	462	452	685	685	685	685	685										
0130	36																														
0230	3[illegible]	90	65	65	55	90	265	265	265	265	265	462	460	482	482	452	685	685	685	685	685										
0330		90	65	65	55	90	265	265	265	265	265	485	460	485	485	485	685	685	685	685	685										
0430	39																														
0530	41	90	65	65	55	90	265	265	265	265	265	465	460	465	465	455	685	685	685	685	685										
0630	41	90	65	65	55	90	265	265	265	265	265	465	460	465	495	450	685	685	685	685	685										
0730	41																														
0830	43	448	395	350	330	496	461	468	480	461	484	470	350	355	466	451	424	483	452	478	462										
0930	41	483	365	325	330	482	450	459	460	448	465	457	38[illegible]	447	450	441	420	428	455	431	460										
1030	45	457	354	366	327	456	483	430	482	434	412	423	431	452	468	431	458	455	460	416	416										
1130	46	446	300	360	324	449	425	426	425	426	453	420	304	421	424	421	454	450	421	446	43[illegible]										
1230	47																														
1330	4[illegible]	93	75	75	70	93	280	290	290	290	290	495	495	495	495	495	640	640	690	690	690										
1430	49	90	75	75	70	96	290	290	290	290	290	490	470	490	490	496	640	640	640	640	690										
1530	5[illegible]	90	75	75	70	96	290	290	290	290	260	440	470	490	490	490	640	640	640	640	690										
1630	[illegible]																														
1730	[illegible]	90	75	75	70	90	340	340	424	340	290	490	470	496	410	490	640	640	650	640	690										
1830		322	367	323	314	288	279	323	257	339	290	275	305	368	276	327	405	342	329	264	345										
1930	[illegible]																														
2030	[illegible]																														
2130		237	214	262	227	209	197	223	181	241	172	158	257	241	198	240	249	214	225	185	255										
2230	Shu[illegible]	233	234	243	257	208	185	273	181	257	183	156	242	230	193	228	248	246	228	181	228										
2330		52	50	52	52	50	240	240	240	[illegible]	[illegible]	440	[illegible]	440	[illegible]	446	[illegible]	440	440	640	[illegible]										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

Page 1 of 6

	Equip.	1 PB	2	3	4	5	6 SP	7 Roof	8	9	10	11	12	13	14	15	16	17	18	19	20 CP	21	22	23	24	25	26	27	28	29	30
0030	[illegible]																														
0130	[illegible]	50	50	50	50	50	[illegible]	[illegible]	140		[illegible]	144	150	140	140	140	150	140	140	140	150										
0230	[illegible]	45	45	45	45	45	135	150	135	145	135	135	145	145	135	145	140	140	140	135	140										
0330	[illegible]																														
0430	[illegible]	40	45	45	45	40	131	144	[illegible]	150	130	135	140	140	135	140	140	140	140	130	140										
0530	[illegible]	35	35	40	40	35	140	148	140	140	130	135	143	135	135	135	140	130	140	130	140										
0630	[illegible]																														
0730	[illegible]	35	35	35	42	35	[illegible]	[illegible]	134	[illegible]	[illegible]	130	140	130	130	130	130	130	130	130	135										
0830	[illegible]	35	35	35	42	35	135	145	135	135	130	135	145	130	130	130	[illegible]	130	130	130	130										
~~0930~~ 0940		166	171	183	197	153	144	200	136	168	141	[illegible]	185	159	142	154	156	152	151	135	158										
1030	[illegible]	164	169	179	194	151	143	196	134	165	143	138	183	157	141	152	154	151	149	134	157										
1130	[illegible]																														
1230	[illegible]	35	35	35	40	35	133	140	133	133	130	130	140	130	130	130	130	130	130	130	130										
1330	[illegible]	35	35	35	35	35	133	140	130	133	130	130	138	130	130	130	130	130	130	130	135										
1430	[illegible]																														
1530	[illegible]	33	32	32	32	33	130	136	125	130	130	130	135	130	130	130	130	130	130	130	130										
1630	[illegible]	30	30	30	30	30	130	135	125	130	125	125	135	125	125	125	130	130	130	[illegible]	130										
1730	[illegible]																														
1830	[illegible]	30	30	30	30	[illegible]	120	125	120	125	125	125	130	125	125	125	125	125	125	125	125										
1930		27	27	27	27	27	125	125	120	120	125	120	120	120	120	120	120	120	120	120	120										
2030	[illegible]																														
2130		25	25	25	25	30	123	129	123	129	120	120	130	120	120	120	120	120	120	120	120										
2230	[illegible]	27	25	25	25	20	121	124	121	124	118	120	125	120	120	120	120	120	120	120	120										
2330	[illegible]																														

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177-857c

Date: Mon. 7 Aug 89 Test: T8 400°/36 hrs

DATA SHEET 3
Page 5 of 6

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
						SP	Roof	EXIT Gas	LH wall	AS2	SSR1	wall RH side	SSR internal	SM external	SSR2 internal	CP internal	Lefthand wall D.6.	SHR2 internal	Air cent	CP										
0030	20	25	25	25	20	20	25	220	225	215	420	425	425	420	425	620	620	620	620	620										
0130																														
0230	135	143	154	166	126	120	156	118	137	120	120	155	130	121	127	128	121	124	110	128										
0330	133	140	152	163	124	121	152	116	135	118	117	154	127	120	125	126	118	122	109	125										
0430	133	139	149	161	124	118	157	112	132	117	115	152	126	115	123	124	120	120	108	125										
~~0630~~ 0506	129	136	147	160	120	117	150	112	131	115	114	151	124	117	122	123	116	120	108	123										
0630	129	134	145	157	121	112	153	108	128	112	111	147	123	115	119	120	117	117	105	122										
0730																														
0845	130	131	144	154	122	116	149	110	128	114	114	147	122	114	116	119	118	118	109	123										
0930	[illegible]																													
1030																														
1130	129	118	142	152	121	118	146	114	126	118	118	145	123	116	121	120	118	119	112	124										
1230 40	131	115	143	152	122	120	148	115	131	120	121	145	125	117	123	121	120	121	113	125										
1330	130	117	143	152	119	117	147	114	128	117	117	145	125	114	122	121	118	120	111	124										
1430	125	116	140	150	118	116	145	111	126	117	117	143	123	114	121	124	115	117	109	122										
1530	122	117	137	148	112	113	145	108	125	114	115	144	120	112	119	118	119	116	139	119										
1630																														
1730	20	20	20	20	20	220	225	220	220	220	420	425	420	420	420	620	620	620	620	620										
1830																														
1930	20	20	20	25	20	220	225	220	220	220	420	425	420	420	420	620	620	620	620	620										
2030	20	20	20	25	20	220	220	220	220	219	419	427	419	417	419	620	620	620	620	620										
2130																														
2230	20	20	20	25	20	220	222	220	220	220	420	425	415	420	420	620	620	620	620	620										
2330	20	20	20	20	20	220	225	220	220	220	420	425	420	420	420	620	620	620	620	620										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177-857c

[illegible] Aug 1987 [illegible] / 56 hrs. [illegible] Page [illegible] of 6

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
0030																														
0130	20	20	20	20	20	218	223	218	218	218	418	425	418	418	418	616	618	618	618	618										
0230	20	20	20	20	20	218	223	218	218	218	418	425	418	418	418	618	618	618	618	618										
0330																														
0430	20	20	20	20	20	218	223	218	218	218	418	425	418	418	418	618	618	618	618	618										
0530																														
0630																														
0730																														
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1830																														
1930																														
2030																														
2130																														
2230																														
2330																														

Key:
- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

177-837c

0715 MOLYTEK FAILED IN POWER OUTAGE

DATA SHEET 4
PAGE 1 OF 7

Test Number	T-8		Run 8
Temperature	600 Deg F	Heat-up Start	29
Time	36 Hours	Steady State Start	34
Date of Test	3-Aug-88	Steady State Stop	71
		Test End	132

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HAC-201	FI-201	T/C-204	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(IWC)	(Deg F)	(Deg F)	(IWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0	-0.10	-0.07	30.00	31.50	-0.16	382.90			12.80	0.30	70.00	20.00	96.00		2.40	1.00	7.30	17.30	10.10	8.40
100	0.10	-0.06	32.00	31.00	-0.17	443.50			12.60	0.30	70.00	20.00	100.00		1.90	1.70	1.40	17.00	17.90	9.60
200																				
300	-0.10	-0.07	30.00	33.00	-0.15	516.00			18.60	0.30	72.00	20.00	90.00		1.50	1.30	1.20	16.60	10.20	8.40
400	0.40	-0.07	35.00	34.00	-0.15	507.90			18.00	0.20	74.90	20.00	100.00		1.00	1.10	1.30	16.50	10.00	9.20
500	0.00	-0.05	41.00	56.00	-0.15	642.83			18.00	0.30	74.00	20.00	120.00	0.60		1.40	[illegible]	[illegible]	[illegible]	[illegible]
600	-0.20	-0.04	41.50	58.00	-0.15	803.00			18.10	0.50	74.00	20.00	102.00		1.50	2.00	2.00	19.30	16.50	14.00
700	0.00	-0.04	45.00	56.00	-0.13	977.00			17.60	1.00	75.00	20.00	104.00	0.60		0.70	3.20	18.00	15.30	11.30
800	0.00	-0.04	30.00	55.00	-0.15	1194.00			13.30	0.90	74.00	20.00	102.00		1.10	0.00	3.00	13.10	15.10	22.90
900	0.00	-0.06	36.50	55.00	-0.15	1410.00			15.90	1.30	74.00	20.00	110.00			-0.10	4.40	-0.20	13.30	43.10
1000	0.00	-0.06	36.00	55.00	-0.16	1571.50			17.00	3.40	73.66	19.50	114.00	0.60		0.00	3.70	-1.50	11.00	54.00
1100	0.00	-0.06	34.00	58.90	-0.16	1790.00			16.40	3.40	74.00	19.50	112.00	0.60		-0.10	5.90	-1.60	11.00	60.50
1200	66.20	1.00	530.00	125.00	-0.06	1842.00	16.60	1.20	14.00	6.00	74.00	13.00	130.00	32.60	22.00	0.10	6.70	-3.30	10.20	55.90
1300	66.20	1.07	590.00	224.00	-0.05	1841.60	16.60	1.20	14.50	6.00	72.00	18.00	112.00	30.00	33.70	0.30	6.00	-1.30	9.00	56.00
1400	66.20	1.06	581.00	311.00	-0.04	1854.90	16.40	1.30	15.00	6.30	72.00	10.00	120.00	36.60	38.70	0.10	6.90	-1.20	9.00	56.90
1500	70.10	1.27	633.00	282.00	-0.04	1845.00	16.30	1.60	14.60	6.00	72.00	10.00	126.00	61.00	65.00	0.10	6.90	-1.10	10.00	56.10
1600	70.00	1.23	666.00	303.00	-0.03	1850.00	16.20	1.70	14.50	6.70	70.00	10.00	126.00	60.20	47.00	0.00	6.60	-1.00	10.30	58.10
1700	55.05	1.30	732.65	299.00	-0.07	1862.00	16.40	1.60	14.20	6.00	70.00	10.90	134.06	54.70	63.00	0.15	6.05	-0.96	11.30	53.60
1800	60.30	1.27	726.30	300.00	-0.05	1823.00	15.00	2.10	14.20	6.90	60.00	10.30	134.00	62.10	41.00	0.10	6.40	-1.00	10.70	57.20
1900	60.50	1.24	717.00	317.00	-0.05	1875.00	15.80	2.00	14.20	6.00	76.00	15.00	121.00	50.20	64.00	0.20	6.50	-1.20	10.60	55.30
2000	60.90	1.25	711.00	324.60	-0.06	1853.00	16.40	1.90	14.40	6.70	60.00	15.00	130.00	55.20	42.00	0.00	6.60	-0.00	10.50	121.63
2100	63.00	1.27	706.00	330.00	-0.06	1856.00	16.35	2.00	14.40	6.90	70.00	10.00	134.06		43.70	0.30	6.30	0.00		54.90
2200																				
2300	60.90	1.25	704.00	320.00	-0.06	1866.00	15.00	1.00	14.40	6.00	70.00	10.00	136.00	47.30	30.00	0.10	6.40	0.30	10.70	56.00
2400	60.00	1.25	655.00	330.00	-0.05	1863.00														
2500																				
2600	60.90	1.26	701.00	332.00	-0.07	1863.00	15.00	2.06	14.00	6.00	72.00	10.00	124.00	45.00	32.90	0.10	6.30	0.00	10.90	57.10
2700														43.50	34.00	0.10	6.20	6.10	10.90	57.00
2800														43.90	33.50	0.10	3.30	5.90	10.90	56.00
2900														44.00	34.30	0.10	6.30	5.70	10.00	57.00
3000														45.70	34.70	0.10	6.35	6.00	10.70	56.90
3100														47.20	36.50	0.10	6.00	5.70	10.70	56.50
3200	60.36	1.25	687.00	341.00	-0.06	1851.00	15.50	1.60	15.00	6.60				50.50	38.30	0.10	6.00	5.10	10.70	54.70
3300														51.00	39.00	0.15	6.00	5.00	10.70	56.00
3400														50.00	38.60	0.10	6.54	5.40	10.60	55.30
3500														50.00	38.00	0.10	6.00	5.10	10.60	56.10
3600														51.50	40.40	0.10	6.53	5.50	10.60	55.70
3700														56.50	45.30	0.10	6.50	5.10	10.50	53.50
3800														56.20	44.90	0.10	6.56	5.30	10.56	54.30
3900														[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Test Number	T-6		Run #		
Temperature	666 Deg F	Heat-up Start	23		
Time	36 Hours	Steady State Start	34	Range #1 d34..d71	
Date of Test	3-Aug-88	Steady State Stop	71	Range #2 d25..d71	
		Test End	112	Range #3 d25..d112	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-201	PI-203	TIC-204	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000														55.40	44.50	0.10	6.60	5.30	10.50	56.50
4100														55.00	44.30	0.10	6.60	5.20	10.50	56.10
4200														56.0	44.80	0.10	6.60	5.00	10.40	56.36
4300														56.30	43.70	0.10	6.60	5.20	10.50	56.30
4400																				
4500	60.90	1.27	543.00	364.00	-0.05	1047.00	16.20	1.70	14.60	6.40	70.00	19.00	134.00	54.00	41.20	0.10	6.50	-0.30	10.60	56.40
4600	60.90	1.27	574.00	347.00	-0.05	1058.00	16.60	1.20	14.60	6.60	70.00	19.00	129.00	44.60	36.00	0.10	6.10	-0.70	11.10	53.00
4700	60.90	1.26	561.60	335.00	-0.06	1062.00	16.60	1.20	14.40	6.00	72.60	18.00	136.00	45.00	34.40	0.00	6.10	-0.00	11.10	50.40
4800	60.90	1.23	573.00	331.05	-0.07	1065.00	16.40	1.30	14.60	7.00	72.00	18.00	124.00	44.00	34.30	0.00	6.30	-0.70	11.20	50.30
4900																				
5000																				
5100																				
5200																				
5300																				
5400	60.90	1.37	406.00	302.00	-0.00	1031.00	17.40	0.00	15.30	7.60	70.00	20.00	116.00		1.40	0.10	4.50	-0.60	13.30	73.30
5500	60.10	0.94	64.00	102.90	-0.27	1175.00														
5600																				
5700	56.00	0.96	30.00	130.00	-0.23	1572.00			15.40	5.00	76.00	15.00	112.00	0.50	1.60	-0.10	4.00	0.60	13.30	50.30
5800	60.00	0.50	25.00	120.00	-0.10	1575.00			15.40	6.90				0.50	1.10	-0.10	5.10	-1.00	13.00	52.50
5900																				
6000																				
6100																				
6200																				
6300																				
6400																				
6500																				
6600																				
6700																				
6800																				
6900	60.00	0.40	27.00	85.00	-0.14	1022.00	18.25	0.00	14.70	7.00	71.00	19.30	120.00	10.00	23.60	0.30	4.00	6.20	13.30	50.90
7000	60.00	0.51	27.00	85.00	-0.14	1027.00								0.70	2.60	4.40	4.10	10.10	11.00	50.30
7100														0.60	1.50	0.10	4.90	5.90	13.10	53.00
7200														6.30	1.00	0.10	4.00	25.60	13.30	47.40
7300														6.60	1.40	0.10	4.00	5.60	13.30	48.10
7400														6.50	1.30	0.10	4.00	5.00	13.00	50.40
7500														0.60	1.10	0.10	5.60	3.70	12.20	50.20
7600														0.50	1.20	0.10	5.64	2.00	12.20	56.10
7700														0.70	1.10	0.10	5.50	4.00	12.30	55.60
7800														0.50	1.10	0.35	5.50	4.00	12.30	56.50
7900														0.40	1.00	0.10	5.50	4.10	12.30	56.20

Test Number	T-8		Run 8
Temperature	400 Deg F	Heat-up Start	23
Time	36 Hours	Steady State Start	34
Date of Test	3-Aug-88	Steady State Stop	51
		Test End	122

Range #1 434..471
Range #2 435..471
Range #3 423..4122

Elapsed Time (Hours)	Air Heater Inlet Damper Position MAC-201	Air Heater Inlet Air Flow FC-202 (INWC)	Air Heater Yc ? TIC-204 (Deg F)	After Burner Inlet Temp TI-224 (Deg F)	Building Draft PIC-221 (INWC)	After Burner Exit Temp TIC-324 (Deg F)	Air Heater Gas Pressure PI-303 (PSIG)	Air Heater Burner Pressure PI-310 (PSIG)	After Burner Gas Pressure PI-323 (PSIG)	After Burner Burner Pressure PI-330 (PSIG)
80.00										
81.00										
82.00										
83.00										
84.00										
85.00										
86.00	63.00	0.51	23.00	64.00	-0.14	1046.00				
87.00	60.00	0.51	21.00	65.00	-0.14	1082.00	15.70	0.00	14.70	7.00
88.00	60.06	0.51	18.60	63.00	-0.14	1065.00	15.50	0.00	14.60	6.90
89.00	60.20	0.50	20.00	61.00	-0.15	1066.00	15.60	0.00	14.60	6.90
90.00	60.00	0.50	17.00	60.00	-0.07	1032.00	15.30	0.00	14.50	7.00
91.00	60.00	0.50	15.00	58.00	-0.08	1052.00	15.20	0.00	14.50	7.00
92.00										
93.00	60.00	0.40	25.00	62.00	-0.08	1079.00			14.00	6.90
94.00	60.00	0.47	23.00	62.00	-0.07	1073.00				
95.00	60.00	0.40	21.00	63.00	-0.07	1076.00	17.00	0.00	14.00	7.00
96.00										
97.00	60.00	0.42	23.00	65.00	-0.08	1080.00	16.90	0.00	14.00	7.30
98.00	60.06	0.45	23.00	61.00	-0.07	1514.00	15.90	0.00	14.70	7.30
99.00	60.00	0.46	23.00	61.00	-0.13	1160.00			14.00	7.30
100.00										
101.00										
102.00										
103.00										
104.00										
105.00										
106.20										

Elapsed Time (Hours)	Propane Tank Temp (Deg F)	Propane Line Pressure (PSIG)	Propane Line Temp (Deg F)	Air Heater Exit THC (ppm/v)	Flash Chamber Exit THC (ppm/v)	After Burner Exit THC (ppm/v)	After Burner Exit CO2 (%)	After Burner Exit CO (ppm/v)	After Burner Exit O2 (%)	After Burner Exit NOX (ppm/v)
80.00				0.60	1.00	0.50	5.50	4.60	12.20	58.50
81.00				0.70	1.20	0.30	5.50	4.50	12.30	55.40
82.00										
83.00										
84.00										
85.00										
86.00										
87.00	71.00	19.00	127.00		0.00	-0.20	4.60	-0.60	13.20	56.10
88.00	71.00	19.00	125.00	0.50		-0.20	4.80	-0.60	13.30	57.60
89.00	69.00	19.60	122.00	0.40		0.10	4.90	-0.70	13.10	55.70
90.00	69.00	19.00	125.00	0.40	0.90	-1.20	5.90	-2.20	11.50	72.30
91.00	69.00	19.20	120.00		1.00	-0.19	6.10	-1.80	12.00	70.90
92.00										
93.00	70.06	19.00	126.00	0.50	1.00	0.00	5.00	-1.20	11.70	70.00
94.00										
95.00	71.00	19.00	126.00	0.40	1.00	0.20	6.90	-1.00	12.00	60.00
96.00										
97.00					1.50	2.50	6.10	-1.30	10.50	80.40
98.00	71.00	19.20	117.00	0.50		0.00	6.20	-2.50	11.00	64.50
99.00	72.00	19.00	114.00	0.50	1.00	0.00	6.90	-0.30	13.50	67.10
100.00										
101.00										
102.00										
103.00										
104.00										
105.00										
106.20										

Steady State Values
Data Range #1

	MAC-201	FC-202	TIC-204	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330
Data Pts	14	14	14	14	14	14	14	13	13	13
Total	878.90	17.77	9132.00	4532.00	-0.81	25317.00	210.60	20.50	189.00	36.70
Mean	60.81	1.27	652.29	328.60	-0.06	1851.21	15.04	1.58	14.54	6.62
Maximum	70.00	1.31	730.30	364.00	-0.05	1875.00	17.40	3.10	15.20	7.40
Minimum	60.00	1.26	606.00	290.00	-0.08	1002.00	0.00	0.00	14.20	6.66

	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
Data Pts	12	12	12	28	29	23	29	29	28	29
Total	850.00	223.00	1516.00	1373.30	1109.60	3.90	180.60	85.30	302.60	1720.30
Mean	70.83	19.00	126.33	49.26	38.26	0.19	6.23	2.94	10.80	59.32
Maximum	70.00	20.00	134.00	62.10	64.50	0.32	6.60	8.10	13.20	124.00
Minimum	60.00	19.02	118.00	0.00	1.40	5.65	3.28	-1.22	10.40	53.40

Test Number	T-6		Run 6		
Temperature	600 Deg F	Heat-up Start	23		
Time	36 Hours	Steady State Start	34	Range #1 d34..d71	
Date of Test	3-Aug-88	Steady State Stop	71	Range #2 d23..d71	
		Test End	129	Range #3 d23..d122	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-304	FI-332	TIC-304	TI-324	PIC-324	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(LBMC)	(Deg F)	(Deg F)	(INWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
Heat-up + Steady State Values																				
Data Range #2																				
Data Pts	18	19	19	19	19	19	19	18	18	18	17	17	17	33	34	34	34	34	33	34
Total	1347.60	23.54	12282.00	6731.00	-1.02	35101.00	292.80	27.50	261.00	122.20	1210.00	324.00	2106.30	1602.50	1266.00	3.40	214.50	78.50	352.50	2004.00
Mean	68.34	1.24	648.21	364.79	-0.06	1652.16	15.41	1.53	14.56	6.79	71.10	18.06	124.00	46.56	37.02	0.10	6.31	2.31	10.69	58.94
Maximum	90.10	1.37	720.00	361.00	-0.03	1843.00	17.40	2.10	15.20	7.40	78.00	20.00	134.00	67.00	47.00	0.30	6.90	6.15	13.20	124.00
Minimum	65.20	1.07	406.00	185.00	-0.09	1802.00	0.00	0.00	14.20	6.30	68.00	18.06	100.00	0.00	1.40	0.00	3.20	-2.30	9.00	53.40
Total Treatment Values																				
Data Range #3																				
Data Pts	36	36	36	36	36	36	28	27	31	31	28	28	28	55	56	58	58	58	58	58
Total	2032.50	32.74	12651.00	7166.00	-3.03	65456.00	438.90	27.50	454.10	212.00	1536.00	533.40	3460.00	1624.00	1334.50	11.40	346.40	152.40	663.73	3556.30
Mean	56.46	0.91	351.42	199.06	-0.08	1818.33	15.67	1.02	14.65	6.84	71.07	19.05	123.06	29.53	23.83	0.19	5.87	2.58	11.44	60.43
Maximum	77.30	1.37	720.00	361.50	-0.03	1914.00	18.20	2.10	15.40	7.40	78.00	20.00	134.00	67.00	47.00	4.40	6.90	25.60	13.50	124.00
Minimum	46.30	0.42	15.00	50.00	-0.33	1046.00	0.00	0.00	14.30	5.60	68.60	13.00	100.00	0.00	0.50	-0.20	3.20	-2.50	9.00	47.10

Test Number T-8 Run 1
Temperature 400 Deg F
Time 36 Hours
Date of Test 3-Aug-88

Heat-up Start 20
Steady State Start 34
Steady State Stop 70
Test End 88

Range #1 414..478
Range #2 428..470
Range #3 426..448

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right	Diffuser	Steel Pipe	Amb	Exit Gas	Diffuser Left Wall	Powder Box 2	Shell Support Back Surface	Wall Right Side	Ship Riser Internal	Ship Riser External	Steam Heated Riser Internal	Clay Pipe Internal	Diffuser Bracket Left Wall	Steam Heated Riser Surface	Rail Cart	Clay Pipe External
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
2	100.0	113.05	122	128	106.00	103	125.0	99.0	104.0	103.0	103	122.0	103	106.0	95.0	76.0	109.0	97.0	100.0	92.0
100																				
200	110.0	115.00	123	130	107.00	106	126.0	101.0	110.0	106.0	106	122.0	108	107.0	142.0	83.0	111.0	103.0	104.0	100.0
300	111.0	115.00	124	128	104.00	107	126.0	102.0	111.0	157.0	108	122.0	110	108.0	165.0	87.0	112.0	106.0	105.0	103.0
400																				
500	112.0	114.00	126	128	109.00	108	126.0	102.0	111.0	108.0	108	122.0	112	110.0	108.0	89.0	112.0	108.0	107.0	166.0
600																				
700	113.0	115.00	124	129	110.00	108	126.0	103.0	112.0	109.0	110	122.0	113	111.0	110.0	98.0	113.0	110.0	108.0	108.0
800																				
900																				
1000																				
1100	266.0	135.00	134	138	235.00	212	255.0	260.0	217.0	227.0	235	130.0	174	263.0	140.0	101.0	238.0	166.0	120.0	166.0
1200	266.0	157.00	162	142	322.00	267	296.0	303.0	267.0	284.0	267	150.0	306	300.0	190.0	132.0	315.0	216.0	257.0	225.0
1300	320.0	181.00	187	150	341.00	284	311.0	321.0	289.0	306.0	306	170.0	254	319.0	237.0	162.0	326.0	240.0	270.0	251.0
1400	343.0	194.00	207	174	365.00	316	328.0	338.0	328.0	323.0	321	192.0	300	332.0	264.0	186.0	353.0	274.0	304.0	278.0
1500	380.0	210.00	230	189	387.00	343	359.0	371.0	332.0	351.0	350	200.0	300	361.0	282.0	203.0	381.0	302.0	340.0	311.0
1600	406.0	236.00	247	202	411.00	360	384.0	387.0	353.0	380.0	370	222.0	332	382.0	316.0	200.0	406.0	324.0	361.0	336.0
1700	424.0	252.00	263	214	429.00	386	397.0	402.0	373.0	404.0	382	237.0	353	405.0	337.0	229.0	432.0	347.0	379.0	361.0
1800	435.0	261.00	277	226	446.00	397	406.0	417.0	385.0	418.0	390	250.0	363	404.0	365.0	250.0	436.0	361.0	382.0	376.0
1900	438.0	277.00	287	236	446.00	403	415.0	416.0	394.0	426.0	410	256.0	381	410.0	363.0	267.0	445.0	376.0	400.0	389.0
2000	440.0	284.00	294	242	456.00	414	421.3	424.0	402.0	430.0	415	265.0	390	423.0	380.0	600.0	452.0	385.0	416.0	406.0
2100	442.0	296.00	306	256	453.00	415	421.0	428.0	407.0	427.0	418	277.0	388	453.0	381.0	533.0	451.0	386.0	427.0	435.0
2200																				
2300	447.0	302.00	311	262	458.00	422	427.0	428.0	409.0	430.0	421	281.0	400	424.0	394.0	404.0	453.0	388.0	426.0	420.0
2400	450.0	304.00	314	266	455.00	419	427.9	434.0	410.0	425.0	416	284.0	402	426.0	396.0	431.0	452.0	395.0	421.0	423.0
2500	444.0	307.00	317	270	456.00	418	422.0	429.0	412.0	436.0	418	287.0	403	424.0	397.0	471.0	453.0	400.0	425.0	421.0
2600	456.0	311.00	321	274	460.00	419	424.0	435.0	415.0	437.0	420	290.0	405	426.0	399.0	458.0	452.0	402.0	423.0	423.0
2700																				
2800																				
2900																				
3000																				
3100																				
3200	465.0	332.00	343	295	472.00	433	438.0	548.0	432.0	453.0	434	311.0	423	435.0	417.0	444.0	460.0	430.0	447.0	437.0
3300																				
3400																				
3500																				
3600																				
3700																				
3800																				

Test Number	T-8		Run #		
Temperature	600 Deg F	Heat-up Start	28		
Time	36 Hours	Steady State Start	34	Range #1 434..470	
Date of Test	3-Aug-88	Steady State Stop	70	Range #2 428..470	
		Test End	88	Range #3 428..468	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Steel Pipe	Roof	Exit Gas	Diffuser Left Wall	Powder Box 3	Shell Support Back Surface	Wall Right Side	Skip Hine Internal	Skip Hine External	Steam Heated Riser Internal	Clay Pipe Internal	Diffuser Bracket Left Wall	Steam Heated Riser Surface	Rail Cart	Clay Pipe External
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
4000																				
4100																				
4200																				
4300																				
4400	481.0	373.00	380	338	456.00	466	463.0	480.0	461.0	444.0	470	350.0	455	466.0	451.0	479.0	493.9	452.0	478.0	456.0
4500	475.0	364.00	375	330	442.00	450	454.0	460.0	446.0	465.0	451	346.0	447	450.0	444.0	478.0	477.0	445.0	471.0	464.0
4600	451.0	354.00	366	327	456.00	433	430.0	432.0	431.0	442.0	427	338.0	432	428.0	431.0	460.0	455.0	430.0	446.0	446.0
4700	447.0	360.00	360	334	440.00	425	426.0	425.0	425.0	432.3	430	334.0	421	424.0	421.0	454.0	450.0	421.0	446.0	433.0
4800																				
4900																				
5000																				
5100																				
5200																				
5300								414.0												
5400	322.0	307.00	323	314	300.00	279	333.0	254.0	330.0	300.0	335	303.0	300	276.0	357.0	405.0	317.0	320.0	264.0	345.0
5500																				
5600																				
5700	237.0	240.00	263	267	200.00	197	270.0	181.0	241.0	197.0	180	243.0	211	196.0	240.0	253.0	214.0	225.0	185.0	233.0
5800	234.0	224.00	245	251	206.00	195	213.0	161.0	237.0	153.0	186	242.0	236	153.0	228.0	248.0	216.0	218.0	191.0	228.0
5900																				
6000																				
6100																				
6200																				
6300																				
6400																				
6500																				
6600																				
6700																				
6800	166.0	171.00	182	187	153.00	144	200.0	136.0	158.0	144.0	138	165.0	158	142.0	154.0	156.0	152.0	151.0	135.0	158.0
6900	164.0	160.00	179	184	151.00	143	196.0	134.0	165.0	143.0	138	183.0	157	141.0	152.0	154.0	151.0	149.0	134.0	157.0
7000																				
7100																				
7123																				

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Steady State Values
Data Range #1

Data Pts	14	14	14	14	14	14	14	15	14	14	14	14	14	14	14	14	14	14	14	14	0

13-Jan-90

DATA SHEET 4
PAGE 7 OF 7

Test Number	T-6		Row 8		
Temperature	600 Deg F	Heat-up Start	28		
Time	36 Hours	Steady State Start	34	Range #1 434..470	
Date of Test	3-Aug-88	Steady State Stop	70	Range #2 428..470	
		Test End	88	Range #3 428..488	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Steel Pipe	Roof	Exit Gas	Diffuser Left Wall	Powder Box 3	Shell Support Rack Surface	Wall Right Side	Skip Bin Internal	Skip Bin External	Steam Heated Riser Internal	Clay Pipe Internal	Diffuser Bracket Left Wall	Steam Heated Riser Surface	Rail Cart	Clay Pipe External	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Total	6315.0	4373.0	6514.0	3311.0	6411.0	5902.0	5375.0	6472.0	5804.0	6150.0	5901.0	4187.0	5679.0	5962.0	5582.0	6217.0	6370.0	5633.0	6011.0	5394.0	0.0
Mean	451.1	312.4	322.4	275.1	458.1	421.4	426.5	431.5	414.6	439.3	421.5	293.4	405.6	425.9	358.7	444.1	455.0	402.4	429.4	428.4	[illegible]
Maximum	491.0	373.0	380.0	330.0	486.3	466.0	463.0	480.0	461.0	484.0	470.0	350.6	455.0	466.0	451.0	648.6	483.0	452.0	478.0	458.0	[illegible]
Minimum	424.0	252.0	263.0	214.5	429.0	306.0	357.0	402.0	373.0	404.0	382.0	237.0	363.0	404.0	337.0	229.0	432.0	347.0	379.7	361.0	[illegible]

Heat-up + Steady State Values
Data Range #2

Data Pts	20	20	20	20	20	20	20	21	20	20	20	20	20	20	20	20	20	20	20	20	0
Total	8345.0	5483.0	5679.0	4844.0	8510.0	7700.0	7323.0	8470.0	7590.0	8046.0	7770.0	5205.0	7194.0	7321.0	7425.0	7210.0	8419.0	7163.0	7747.0	7557.0	0.0
Mean	417.3	274.5	284.0	242.2	425.0	385.0	366.2	403.3	379.5	402.3	388.5	260.3	359.7	366.1	371.3	360.5	421.0	358.2	387.4	377.9	[illegible]
Maximum	484.0	373.0	380.0	330.0	455.0	466.0	463.0	480.0	461.0	484.0	470.0	350.0	455.0	466.0	451.0	648.0	483.0	452.0	478.0	490.0	[illegible]
Minimum	356.0	128.0	134.0	128.0	288.0	318.0	250.0	268.0	317.0	327.0	336.0	130.0	134.0	365.0	140.0	181.0	268.0	166.0	320.0	166.0	[illegible]

Total Treatment Values
Data Range #3

Data Pts	26	26	25	26	26	25	25	26	25	26	[illegible]	25	26	25	26	26	25	26	25	25	0
Total	9660.0	6818.0	6855.0	6073.0	9427.0	8658.0	9203.0	9356.0	8740.0	9013.0	8686.5	6367.0	8329.0	8871.0	8160.0	8412.0	9569.0	8535.0	8646.0	8678.0	0.0
Mean	370.8	272.4	274.3	242.9	361.1	346.3	368.1	359.8	349.6	360.5	347.9	254.7	333.6	354.8	326.4	331.7	370.8	329.4	345.8	347.1	[illegible]
Maximum	481.0	507.0	380.0	337.0	475.0	466.0	463.3	486.0	461.8	484.0	470.0	350.0	455.0	466.0	451.0	648.0	493.0	452.0	478.0	458.0	[illegible]
Minimum	164.0	128.0	134.0	128.0	151.0	143.5	136.0	134.0	165.0	143.0	130.0	128.0	134.0	141.0	140.0	181.0	151.8	140.0	134.0	157.0	[illegible]

July 1990
Revision: Final

TEST RUN 13
500°F/12 HOURS

1311R2

DATA SHEET 1
PAGE 1 OF 1

1306 – 1350 Charli & Paul suited up to do pre-test sampling.

Test 13

Test Run 500° / 12 Hrs

Date 8-7-89

Test Duration

Time

Heat-Up Rate

Flash Chamber Temperature

Flash Chamber Interior

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. PB1	TNT	[illegible]	8#	8#							
2. PB2	TNT	[illegible]	7.5#	8#							
3. SHR1	TNT	[illegible]	11.5#	12.0#							
4. SHR 2	TNT	[illegible]	11.5#	12.0#							
5. SSR1	TNT	[illegible]	26.5#	26.5#							
6. SSR 2	TNT	[illegible]	87.0#	87.0#							
7. AP1	TNT	[illegible]	5.5#	5.5#							
8. AP2	TNT	[illegible]	5.5#	6.5#						has [illegible] on it	
9. CP	TNT	[illegible]	72#	68.5#						brown color	paint peeling
10. SM	TNT		712#	714#							
11.											
12.											
13.											
14.											
15.											

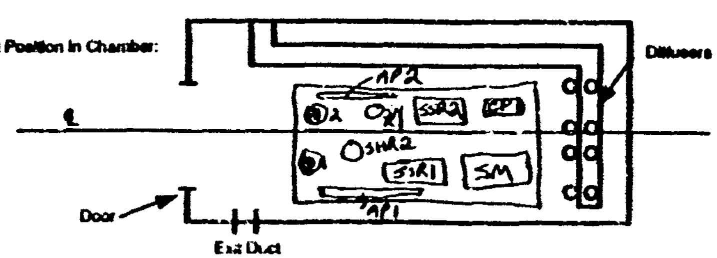
177 887a

← some contamination

→ small drop of ethylenediamine [illegible] caught on fire. used [illegible] to put it [illegible]. Some charred spots looks okay.

↳ Pre-test sampling OVA readings [illegible] in control room, ~0.70 next to the sampling area.

Equipment Position In Chamber:



10:15 AM 8-14-89 - open door on Chamber

Post Test - 8-14-89 1:56 PM Chamber temps 103°F D.B.

Post Test Sampling 8-14-89 1530 hrs - 1630 hrs -

F..T l : ,

DATA SHEET 2
PAGE 1 OF 5

(1)

Date 8/9/89 Test Number T13 500°F/12 hrs

Time	Main Panel: Air Heater Inlet Damper HC-201	Air Heater Inlet Air Flow FI-202 (INWC)	Air Heater Temperature TT-204 (°F)	T.O. Inlet Air Temperature TI-204 (°F)	Bag. Pressure PIC 221 (INWC)	Bleed Air Valve Position HC-22-2	T.O. Temperature TIC-204 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Weather Condition	Air Preheater: Gas Pressure PI-208 (PSIG)	Burner Pressure PI-210 (PSIG)		Afterburner: Gas Pressure PI-223 (PSIG)	Burner Pressure PI-220 (PSIG)		Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (light ON) (PPmv)	Flash Chamber Discharge THC (light OFF) (PPmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100																									
1200																									
1300	18.6	-0.05	31	57	-0.18	0	375	82/69	16.8	0		18.4	0.1		46%	69	80	85	—	—	0.4	1.3	16.[illegible]	[illegible]	[illegible]
1400	18.5	-0.04	32	58	-0.17	0	513														—	—	[illegible]		
1500	[illegible]	-0.04	34	58	-0.17	0	500	85/68	17.1	0		18.6	0			69	20	100	—	—	0.6	1.4	17.3	17.0	[illegible]
1600	18.5	-0.09	32	68	-0.17	0	509	85/69	16.2	0		18.8	0			69	20	99	—	—	0.4	1.3	17.3	17.5	7.6
1700	18.5	-0.08	32	58	-0.18	0	566	83/68	16.2	0		18.5	0.1			69	20	97	—	—	0.4	1.4	12.2	17.4	9.4
1800	28.0	-0.04	28	57	-0.17	0	676		15.4	0		18.3	2.4		-	-	-	-	—	—	1.4	6.7	19.6	16.9	11.0
1900	28.0	-0.04	27	57	-0.17	0	890	82/70	15.5	0		18.2	0.6			69	20	110	—	—	1.5	2.0	21.9	16.3	12.2
2000	28.0	-0.04	23	55	-0.17	0	1124	79/67	15.0	0		18.0	0.9			65	19.7	202	—	—	1.0	2.8	22.6	15.3	7.3
2100	28.6	-0.05	20	55	-0.16	0	1316	75/66	14.9	0		17.0	1.6			—	—	—			-0.3	4.0	14.1	14.0	18.6
2200	28.0	-0.05	18	55	-0.19	0	1180			0															
2300	28.0	-0.05	17	55	-0.16	0	1700																		

→ bugs!

NOTE: Problem w/ the MOLYTEK this test. Some of the thermocouples were bad & ∴ replaced with new ones (Channel #'s 6, 16 & 18) USE Channel 6 to monitor chamber temp since Channel 8 - Exit gas doesn't seem to be reading correctly.

1233 - limits proved (T.O.) - fan running
1235 - T.O. burner ignited - system running
1300 - THC analyzer not on yet due to low amt. of H2

2014 - all power down for ≈ 5 sec.
2020 - T.O. burner re-ignited & 40 [illegible]

DATA SHEET 2
PAGE 2 OF 5

(2)

Thurs.

Date 10 Aug 89 Test Number 773 500°/12 Hrs

Time	Main Panel: Air Heater Inlet Damper HIC-201 (%)	Air Heater Inlet Air Flow PI-202 (INWC)	Air Heater Temperature TIC-204 (°F)	T.O. Inlet Air Temperature TI-201 (°F)	Bag Pressure PIC-221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TE-324 (°F)	Ambient Conditions: Dry Bulb Temperature / Wet Bulb Temperature	Air Preheater: Gas Pressure PI-308 (PSIG)	Burner Pressure PI-316 (PSIG)	Afterburner: Gas Pressure PI-323 (PSIG)	Burner Pressure PI-330 (PSIG)	Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC on (PPMV)	Flash Chamber Discharge THC off (PPMV)	Afterburner Discharge THC	CO_2 (%)	CO	O_2 (%)	NO_x
0000	[illegible]	[illegible]	16	55	-0.16	0	1425	70/64	—	—	17	2.7		66	12	126	[illegible]		0.9	7.1	0.8	7.3	11.1
0100	40.0	[illegible]	608	136	-0.04	0	1119		14	1.0	14.1	7.0		66	19	135	24.	26.4	1.0	7.4	0.2	9.1	57.0
0200	45.1	0.55	652	192	-0.05	0	2[illegible]		16.0	7.2	14.2	6.9		66	19	126	430	20.	1.0	4.3	0.3	7.3	[illegible]
0300	56.9	0.84	771	252	-0.10	0	1915		16.9	2.5	14.9	7.2		66	19	126	64	38	1.0	2.6	0.5	8.6	58.[illegible]
0400	57.0	0.8[illegible]	9[illegible]	298	-0.0[illegible]	0	1[illegible]	70/64	[illegible]	[illegible]	14.0	6.9		63	19	128	[illegible]	63.9	-1.0	6.4	0.4	7.0	57.[illegible]
0500	58.1	0.76	989	317	-0.0[illegible]	0	2007		15.1	1.1	11.0	6.[illegible]		68	18.5	131	55	33	-1.0	[illegible]	0.4	7.2	[illegible]
0600	57.1	0.94	1063	337	-0.07	0	1915		15.2	2.7	14.2	6.1		64	18.5	128	50	37.6	-1.1	[illegible]	0.1	7.2	49.[illegible]
0700	55.4	0.79	1037	342	-0.10	0	1957		15.8	2.5	14.2	7.2		64	18.5	130	46	33.7	-1.0	8.4	0.2	7.3	54.2
0800	50.0	0.65	1090	376	-0.05	0	1918	72/67	15.8	3.7	14.6	6.2		64	19	134	29	13.7	-0.9	8.3	0.0	7.1	58.[illegible]
0900	70.0	1.13	1104	405	-0.07	0	1915		14.8	5.0	14.0	6.9		66	18.5	132	57.0	40	-0.9	7.5	0.8	6.5	48.1
1000	72.1	1.33	1098	428	-0.4	0	1918		15.0	5.5	14.1	7.4		67	20	98	51	27.4	-1.0	7.8	0.4	9.1	46.7
1100	74.0	1.30	1098	442	-0.4	0	1942		15.0	5.9	14.6	7.3		68	19.5	90	50	24.4	-0.9	7.8	0.9	5.5	49.[illegible]
1200	74.0	1.22	1106	452	-0.10	0	1930	81/68	15.2	5.0	14.9	7.3		69	19.5	88	52.4		-0.5	7.4	0.3	7.0	49.[illegible]
1300	57.6	0.82	916	366	-0.10	0	1944																
1400	70.0	1.11	1093	420	-0.09	0	1929	89/66	15.4	4.2	14.8	7.5		70	19.2	89	—	30.2	0.7	7.4	0.1	7.3	58.[illegible]
1500	70.0	1.17	1103	450	-0.05	0	1930	89/66	14.[illegible]	5.2	11.1	7.5		71	19.2	89	~	31.1	-0.3	7.7	0.4	7.2	53.1
1600	70.0	1.17	1103	464	-0.04	0	1952		15.1	5.0	14.6	7.5		71	19.2	82	—	27.7	-0.8	8.0	0.0	7.9	52.0
1700	70.0	1.16	1110	478	-0.06	0	1981	81/69	15.1	5.0	14.5	7.5		70	19.2	83	67	27.9	-1.1	8.2	0.5	7.1	53.[illegible]
1800																							
1900																							
2000																							
2100	61.9	1.15	1094	510	0.04	0	2000	77/65	15.2	4.6	14.3	7.0		71	18.5	120	65	20.6	-1.1	8.6	0.5	6.9	55.[illegible]
2200	62.9	1.16	1113	514	-0.03	0	2000																
2300	58.8	0.78	2000	350	-0.09	0	2017		—	—	15.4	6.9		70	19.5	126		2.0	-1.0	6.2	0.3	0.5	61.[illegible]

01:00 start pretest

06:30 Dewpoint sensor on / augment tar.
7:20 Dewpoint flameout / restart & reburn / draft
8:30 Raised flow to TEST conditions / maintained maintain / T.O. @ 2000°F
0900 Propane 34% / delivery / commenced
1000 completed
1030 STEADY STATE ACHIEVED

1258 - power outage - system down
1301 - T.O. up & running
1321 - A.H. up & running - Rigol you had to bring fuel valve below 30% to get limits proved

2133 - Cy & RJS on site - high building pres. alarm on but everything running. Mike Cosmos said even if chamber temp below 500. count the hours as good. We will avg. the test temp.

DATA SHEET 2
PAGE 3 OF 5

~~Thursday~~ Friday 8/11/89

Date ~~8/10/89~~ Test Number T13 500°F / 12 hrs.

(Thurs. 8-10 2235 hrs Started cool down)

Time	Main Panel: Air Heater Inlet Damper HIC-301	Main Panel: Air Heater Inlet Air Flow PI-302 (inWC)	Main Panel: Air Heater Temperature TIC-304 (°F)	Main Panel: T.O. Inlet Air Temperature TI-304 (°F)	Main Panel: Bag. Pressure PIC 221 (inWC)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-304 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-305 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		After-burner: Gas Pressure PI-323 (PSIG)	After-burner: Burner Pressure PI-320 (PSIG)		Propane Tank: Quantity (gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Air Heater Discharge THC on (ppmv)	Flash Chamber Discharge THC . off (ppmv)	Afterburner Discharge THC (ppm)	Afterburner Discharge CO_2 (%)	Afterburner Discharge CO (ppm)	Afterburner Discharge O_2 (%)	Afterburner Discharge NO_x (ppm)
0000	40.0	0.38	27	287	-0.08	0	1786	72/63				15.4	6.3			70	14.5	127	0.6	—	-0.9	5.7	-0.2	10.9	13.7
0100																									
0200							1986												Out of						
0300																			GAS						
0400																									
0500																									
0600																									
0700							1860																		
0800																									
0900	40.0	0.47	21	127	-0.17	0	1823	72/67				15.6	7.4			68	19	123	out of	GAS		48	0	6	15
1000	35.0	0.35	23	127	-0.04	0	2024					14.8	7.4			68	19.5	130	"	"	—	7.5	0.2	8.4	126
1100	35.0	0.35	25	122	-0.06	0	[illegible]					12.2	6.8			69	19.5	128	"	"	—	7.2	-0.9	8.6	115
1200	35.0	0.31	28	124	-0.04	0	1998	82/56				15.2	7.2			70	20	129	"	"	—	7.7	0.1	[illegible]	[illegible]
1300	35.0	0.35	30	120	-0.05	0	2002	84/46	11.8	0		15.5	7.0			71	19.5	126	"	"	—	7.1	-0.6	8.9	114
1400							1980																		
1500																									
1600																									
1700																									
1800																									
1900							[illegible]																		
2000																									
2100																									
2200																									
2300							1596																		

(4)

DATA SHEET 2
PAGE 4 OF 5

Sat.

Date 8/12/89 Test Number T13 320°/12 Hr

	Time	Main Panel: Air Heater Inlet Damper HIC-301	Air Heater Inlet Air Flow PI-302 (INWC)	Air Heater Temperature TIC-304 (°F)	T.O. Inlet Air Temperature TI-324 (°F)	Bldg. Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-324 (°F)	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		After-burner: Gas Pressure PI-323 (PSIG)	After-burner: Burner Pressure PI-330 (PSIG)		Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (PPmv)	Flash Chamber Discharge THC (PPmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
[illegible]	0000																									
[illegible]	0100	350	0.34	[illegible]	091	-0.06	0	2000																		
61	0200																									
62	0300																									
[illegible]	0400							1910																		
[illegible]	0500																									
[illegible]	0600																									
66	0700																									
67	0800																									
[illegible]	0900							1740																		
69	1000																									
70	1100																									
71	1200	35	0.34	29	78	-0.06	0	1774	82/69	15	B		19	0			70	195	126	0.5	1.2	0.3	2.1	0.3	9.5	104
70	1300							1840																		
73	1400																									
71	1500																									
75	1600																									
76	1700																									
77	1800							1840																		
78	1900																									
79	2000																									
80	2100																									
81	2200																									
82	2300							1740																		

DATA SHEET 2
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(5)

Sunday
Date 8/13/89 Test Number T13 500°/12 hr

Time	Main Panel: Air Heater Inlet Damper HIC-301	Main Panel: Air Heater Inlet Air Flow PI-302 (INWC)	Main Panel: Air Heater Temperature TIC-304 (°F)	Main Panel: T.O. Inlet Air Temperature TI-324 (°F)	Main Panel: Bag Pressure PIC 221 (INWG)	Main Panel: Bleed Air Valve Position HIC-27	Main Panel: T.O. Temperature TIC-324 (°F)	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Air Preheater: Burner Pressure PI-31C (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Afterburner: Burner Pressure PI-33C (PSIG)		Propane Tank: Gallons (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Air Heater Discharge THC (PPmv)	Flash Chamber Discharge THC (PPmv)	Afterburner Discharge THC (ppm)	Afterburner Discharge CO_2 (%)	Afterburner Discharge CO (ppm)	Afterburner Discharge O_2 (%)	Afterburner Discharge NO_x (ppm)
0000																									
0100																									
0200																									
0300							[illegible]																		
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100	35	0.35	25	61	.08	0	1940	80/55	184	0		15	7.5			70	95	128	5	12	0.0	7.0	0.2	9.9	96.7
1200																									
1300																									
1400																									
1500																									
1600																									
1700																									
1800																									
1900																									
2000																									
2100																									
2200																									
2300																									
Monday 8/14 8:00	35	.31	21	52	-.02	0	1915 (12% ...)																		

8/14
8:40 · SAAF SYSTEM DOWN

[illegible] Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	PB						S						S				S				(6)	(16)	(18)							
	[illegible]	[illegible]				[illegible]	PB	[illegible]	[illegible]	[illegible]	SM	AP 1	SM	[illegible]	SSR TOP	SSR TOP	CP	CP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]							
0030																														
0130	232	[illegible]	539	46	247	527	243	214	159	83	106	120	109	411	124	[illegible]	151	165	253	150	177	114	135							
0230	304	[illegible]	414	153	510	520	305	290	258	153	156	155	159	170	57	[illegible]	236	219	308	[illegible]	245	158	214							
0330	367	351	168	164	375	537	379	[illegible]	336	250	225	228	251	253	106	315	304	304	425	222	325	249	294							
0430	328	165	75	145	399	546	465	391	363	340	268	322	305	222	130	393	365	363	457	351	351	314	335							
0530	411	188	220	218	410	675	426	377	381	541	275	341	328	[illegible]	65	419	414	141	423	393	367	399	557							
0630	459	210	463	246	442	700	469	461	410	409	[illegible]	382	338	344	194	463	467	469	502	[illegible]	399	467	400							
0730	450	210	257	257	422	687	150	415	404	372	330	37[illegible]	388	346	201	452	455	455	448	359	3[illegible]	393	457							
0830	493	265	207	277	462	751	501	430	455	426	376	425	417	386	232	503	488	484	545	[illegible]	435	426	447							
0930	(576	314	319	295	492	745	525	481	450	431	467	465	454	416	248	538	519	5[illegible]	570	471	467	460	465							
1030	546	346	346	319	526	763	545	535	465	460	453	487	484	458	265	562	546	546	512	491	492	453	512							
1130	552	360	363	332	541	715	550	506	495	468	453	501	501	463	280	579	563	563	599	520	503	473	527							
1230	551	384	378	344	542	778	570	518	508	471	467	508	511	471	292	587	571	580	606	535	515	466	541							
1330 1345	495	324	345	515	506	749	535	468	453	529	427	460	453	420	192	534	523	529	575	478	477	434	494							
1430	429	307	364	350	543	746	557	484	410	317	455	475	483	436	171	574	559	563	596	539	504	477	534							
1530	468	295	371	367	578	783	590	572	365	389	476	310	499	295	194	599	686	588	620	540	533	513	542							
1630	446	325	371	382	605	787	609	483	557	357	[illegible]	247	470	210	214	612	597	603	638	577	549	542	579							
1730	100	30	50	16	120	355	325	250	[illegible]	240	445	455	450	445	445	425	110	110	125	110	[illegible]	[illegible]								
1830																														
1930																														
2030																														
2130	563	427	320	555	670	604	662	451	[illegible]	482	430	382	482	366	339	659	653	649	666	633	618	623	632							
2230	601	[illegible]	35[illegible]	443	680	822	[illegible]	463	485	482	450	422	509	415	[illegible]	660	656	662	659	633	629	632	646							
2330	465	370	286	420	411	368	431	206	240	281	337	446	389	314	268	487	572	537	469	500	458	483	471							

Key: STEADY STATE AT 1030

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

1258 - power outage.

1320 - A.H. back up & running

T.O. INLET T. meaning 518° AT 1030 [illegible] · SHUTDOWN

177-857c

(2)

DATE: [illegible] May TEST: 113 [illegible] /12 hrs.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Equip.	PB						V			H	H	H	V	Y			V	H	[illegible]	[illegible]	(6)	(6)	118							
		Diffusor					[illegible]	AB1	[illegible]	[illegible]	[illegible]	SM	AP1	SM	[illegible]	SSR Top	SSD	S	S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]							
	0030																														
	0130																														
37	0230	50	50	40	60	50	245	250	220	235	240	410	430	440	440	410	460	460	460	460	[illegible]										
	0330																														
	0430																														
	0530																														
	0630																														
42	0730	30	40	30	50	80	240	240	245	230	250	430	422	430	436	430	445	645	645	605	645										
	0830																														
	0930	203	212	175	249	209	157	201	102	153	163	171	138	169	177	186	223	233	201	230	[illegible]	264	206	221							
	1030	203	207	175	243	206	155	197	109	162	163	175	144	170	181	188	218	229	217	228	219	259	201	217							
	1130	201	204	177	239	201	153	194	117	160	183	179	177	172	184	189	214	224	214	222	219	254	201	214							
	1230	200	201	177	235	198	150	189	124	161	180	178	149	172	186	189	207	217	218	214	207	249	196	200							
	1330	197	197	179	228	197	148	186	126	161	180	179	152	173	187	186	205	212	203	209	201	245	193	203							
41	1430	24	23	24	24	23	220	220	220	220	220	406	426	425	406	425	625	625	625	625	625										
	1530																														
	1630																														
	1730																														
	1830																														
31	1930	24	23	24	24	23	220	220	220	220	220	425	426	425	426	426	425	625	625	625	625										
5	2030																														
	2130																														
	2230																														
	2330	20	20	[illegible]	25	20	220	220	220	220	220	420	420	420	420	420	420	620	620	620	620										

Key.

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177-857c

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
0030 45	163	167	178	150	157	119	151	153	150	157	152	153	162	169	169	160	167	159	164	160	158	153	160							
0130																														
0230																														
0330																														
0430	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
0530																														
0630																														
0730																														
0830																														
0930	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
1030																														
1130																														
1230 12:00	144	142	159	148	137	111	134	127	132	136	139	139	140	146	150	135	145	137	141	140	170	136	139							
1330	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
1430																														
1530																														
1630																														
1730																														
1830	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
1930																														
2030																														
2130																														
2230																														
2330	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Snip Mina - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

Sun 8/15/87 T 13 500°/12 hrs.

DATA SHEET 3
Page 4 of 4

(5)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
0030																														
0130																														
0230																														
0330	20	20	20	20	20	215	215	215	215	215	420	420	420	420	420	620	620	620	620	620										
0430																														
0530																														
0630																														
0730																														
0830																														
0930																														
1030																														
~~1130~~ 1150	122	121	135	143	117	76	113	110	112	114	112	118	118	122	130	117	123	118	117	117	140	117	117							
1230																														
1330																														
1430																														
1530																														
1630																														
1730																														
1830																														
1930																														
2030																														
2130																					(6)	(14)	(18)							
2230	Defrost					[illegible]	PB	[illegible]	[illegible]	SSR	SM	[illegible]	SM	[illegible]	[illegible]	[illegible]	CP	CP	SS	[illegible]	[illegible]	[illegible]	CP							
2330																														

177-857c

8:50 112 113 124 121 108 86 107 99 103 104 105 103 102 112 111 107 101 101 107 106 127 104 106

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

Test Number T-13 Run 4
Temperature 600 Deg F Heat-up Start 25
Time 15 Hours Steady State Start 38 Range #1 438..454
Date of Test 9-AUG-88 Steady State Stop 54 Range #2 439..458
Test End 111 Range #3 423..4111

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOx
	HIC-304	PI-308	TIC-304	TI-324	PIC-321	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0	16.50	-0.06	31.00	37.00	-0.16	375.00	16.00	0.00	18.40	0.10	64.00	20.00	96.00			0.00	1.30	16.50	17.60	0.10
100	16.50	-0.04	32.00	60.00	-0.17	513.00														
200	16.50	-0.04	34.00	56.00	-0.17	500.00	17.10	0.00	18.60	0.00	66.00	20.00	100.00			0.60	1.00	17.20	17.40	8.30
300	16.50	-0.04	32.00	56.00	-0.17	500.00	16.30	0.00	18.00	0.00	68.00	20.00	94.00			0.40	1.30	11.20	17.50	8.60
400	18.00	-0.05	32.00	58.00	-0.18	566.00	15.20	0.00	18.50	0.10	68.00	20.00	97.00			0.40	1.40	17.20	17.40	9.40
500	20.00	-0.04	30.40	51.00	-0.17	675.00	15.40	0.00	18.30	0.40						1.00	1.70	19.60	16.30	11.00
600	20.00	-0.04	27.00	57.00	-0.17	800.00	15.50	0.00	18.30	0.60	33.00	20.00	110.00			1.50	2.00	21.00	16.30	12.80
700	30.00	-0.05	33.00	56.00	-0.17	1134.00	15.00	0.00	18.00	0.86	63.00	18.70	104.60			1.06	3.00	22.50	15.30	17.30
800	20.00	-0.05	27.00	55.50	-0.16	1316.00	14.90	0.00	17.00	1.60						0.00	4.90	14.90	14.60	20.60
900	20.00	-0.05	18.00	56.70	-0.14	1600.00		0.00												
1000	50.00	-0.06	17.00	55.60	-0.16	1700.00														
1100	0.00		16.00	66.00	-0.15	1835.00			17.00	3.70	56.00	19.00	135.00			0.90	7.10	-0.20	9.70	87.10
1200	40.00	0.06	600.00	28.00	-0.06	1860.00	16.40	1.00	14.40	7.60	66.00	19.00	128.00	24.00	25.00	1.00	7.60	-0.30	8.10	57.00
1300	46.10	0.10	683.00	157.00	-0.06	2027.06	16.00	1.35	14.20	6.90	65.00	19.00	126.00	41.00	30.00	1.00	7.30	-0.30	9.30	52.50
1400	56.00	0.02	771.00	266.06	0.06	1945.00	16.00	3.50	14.00	7.20	66.00	19.00	125.00	64.00	30.00	-1.00	7.00	-0.50	8.60	66.30
1500	80.00	0.04	912.00	300.00	-0.03	1964.00	15.20	3.30	14.00	630.00	54.00	18.00	124.00	80.00	63.90	-1.00	6.60	-0.00	7.00	50.10
1600	84.10	0.76	900.00	317.00	-0.06	2007.00	15.60	1.00	14.00	4.00	64.00	18.50	121.00	65.00	25.00	-1.00	8.60	-0.60	7.30	64.10
1700	84.10	0.90	1062.00	333.00	-0.06	1986.00	15.30	1.06	13.20	6.96	64.00	18.50	120.00	50.00	30.60	-1.10	8.30	-0.10	7.40	106.90
1800	66.00	0.70	1037.00	32.00	-0.10	1953.00	15.00	2.50	14.80	7.30	64.00	18.50	130.06	66.00	53.70	-1.00	8.00	-0.20	7.30	54.30
1900	80.80	0.66	1000.00	346.00	-0.06	1990.00	[illegible]	3.70	14.60	6.28	64.00	18.00	124.06	28.00	13.70	-0.90	8.30	0.00	7.10	62.00
2000	54.00	1.11	1104.00	406.00	-0.98	1915.00	11.00	5.30	11.00	6.90	66.00	18.50	112.00	57.00	60.00	0.90	7.00	0.00	8.30	65.90
2100	72.10	1.23	1006.00	420.00	-0.11	1013.00	15.90	5.50	14.00	1.00	67.00	20.00	94.00	51.00	[illegible]	-1.00	1.00	0.00	8.10	60.70
2200	74.00	1.30	1009.00	441.30	-0.06	1942.00	15.30	5.30	[illegible]	7.30	66.00	13.50	90.90	50.00	64.40	-0.90	1.00	0.90	8.30	45.40
2300	74.07	1.23	1106.06	452.00	-0.10	1960.00	15.20	5.00	14.00	7.30	60.00	19.50	40.60	12.40		-0.90	3.40	0.30	9.06	40.60
2400	57.60	0.82	916.05	266.30	-0.10	1944.00														
2500	80.90	1.13	1083.00	426.06	-0.00	1928.00	16.00	4.30	14.00	7.50	70.00	19.20	80.00		26.20	0.70	2.00	-0.10	8.30	58.06
2600	80.80	1.11	1103.00	458.06	-0.06	1940.30	14.00	5.30	14.70	7.58	71.00	19.20	80.00		31.10	-0.35	7.70	-0.07	8.30	63.90
2700	90.30	1.17	1163.00	466.00	-0.06	1962.00	15.10	5.00	14.66	7.50	71.00	19.30	52.00		34.70	-0.80	8.00	0.00	7.90	52.02
2800	90.40	1.12	1110.00	478.00	-0.06	1961.00	15.10	50.00	14.56	7.50	70.00	19.20	83.06	67.00	27.40	-1.10	8.30	-0.56	7.00	53.00
2900																				
3000																				
3100																				
3200	80.00	1.15	1004.0C	516.06	-0.04	2000.00	15.20	4.60	14.30	7.30	71.00	19.50	120.00	65.00	20.60	-1.10	8.60	-0.50	6.90	55.30
3300	80.90	1.16	1111.00	524.06	-0.03	2500.00														
3400	62.00	0.73	260.00	300.00	-0.00	2600.06			15.40	6.90	10.90	13.50	125.65		3.00	-1.00	6.20	-0.30	10.50	112.30
3500	80.60	0.40	29.00	287.00	-0.00	1800.00			15.40	6.30	78.00	14.50	127.09	0.60		-0.90	5.70	-0.36	18.90	21.74
3600																				
3700						1300.00														
3800																				
3900																				

DATA SHEET 4
PAGE 2 OF 8

Test Number	T-11		Run 8	
Temperature	360 Deg F	Heat-up Start	23	
Time	11 Hours	Steady State Start	36	Range #1 430..450
Date of Test	9-AUG-88	Steady State Stop	50	Range #2 425..450
		Test End	111	Range #3 425..4111

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HdC-204	FI-302	TIC-304	TI-324	PIC-321	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(LBHR)	(Deg F)	(Deg F)	(INWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000																				
4100																				
4200						1500.00														
4300																				
4400	40.00	0.47	[illegible]	127.30	-0.17	1852.00			13.50	7.63	60.00	10.00	121.00	0.10	46.50	30.06	6.60	6.60	9.00	101.00
4500	36.00	0.34	22.00	127.00	-0.04	2044.00			14.00	7.00	60.00	10.50	130.00	0.10	0.00	0.10	6.60	10.00	8.40	113.60
4600	36.00	0.36	25.00	127.00	-0.06	2006.00			15.30	6.00	60.00	10.50	125.00	11.70	0.30	3.00	5.90	4.60	5.10	142.30
4700	36.00	0.31	28.00	134.00	-0.04	1990.00			15.30	7.30	70.00	20.00	121.00	0.90	1.00	0.10	7.30	3.00	9.60	101.00
4800	36.00	0.36	30.00	130.00	-0.06	2002.00	15.00	0.00	15.30	7.00	71.00	13.50	125.00	1.10	1.00	6.30	7.30	3.90	9.60	102.30
4900						1900.00								1.10	1.00	0.10	7.30	[illegible]	9.60	104.10
5000														0.90	1.90	0.10	7.30	3.90	9.50	105.70
5100														0.70	1.60	0.10	7.30	3.70	9.50	105.60
5200														0.90	1.00	0.10	7.30	3.70	9.60	105.90
5300														0.60	1.70	0.10	7.30	3.60	9.30	107.40
5400						1900.00								0.30	1.40	0.10	7.30	3.30	9.60	100.00
5500														0.50	1.40	0.10	7.30	3.30	9.40	100.40
5600														0.50	1.30	0.10	7.30	3.00	9.40	100.30
5700														0.50	1.30	0.10	7.30	3.90	9.30	107.00
5800						1890.00								0.50	1.30	0.10	7.30	3.00	9.40	104.30
5900														0.60	1.10	0.10	7.30	2.8	9.40	102.00
6000	36.00	0.34	34.00	31.00	-0.06	2040.00								9.50	1.30	6.10	7.30	2.8	9.50	101.60
6100														0.90	1.10	0.10	7.30	2.8	5.60	103.30
6200														0.50	1.30	0.15	7.30	3	9.50	100.60
6300						1970.00								0.50	1.30	0.70	7.30	3.00	9.50	101.70
6400														0.40	1.30	0.35	7.30	3.00	9.60	101.00
6500														0.40	1.30	0.16	7.10	3.00	9.60	101.00
6600														0.50	1.30	0.10	7.10	3.10	9.70	100.60
6700														0.46	1.50	0.16	7.00	2.60	9.90	100.00
6800						1930.00								0.70	1.60	0.70	6.00	4.60	10.00	99.40
6900														0.10	0.30	4.40	5.00	0.50	8.73	107.60
7000														0.60	1.00	0.10	7.00	3.70	10.00	96.90
7100	36.00	0.34	33.00	70.00	-0.00	1871.00	15.00	0.06	19.00	0.00	70.00	19.50	126.30	0.50	1.60	0.19	6.90	3.00	10.00	101.10
7200						1956.02														
7300																				
7400																				
7500																				
7600																				
7700																				
7800						1960.00														

Test Number	T-13		Run 1		
Temperature	500 Deg F	Heat-up Start	25		
Time	12 Hours	Steady State Start	38	Range #1 438..458	
Date of Test	9-AUG-88	Steady State Stop	50	Range #2 425..450	
		Test End	111	Range #3 425..4111	

Elapsed Time	Air Heater Inlet Damper Position	Air Cooler Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-204	FI-204	TIC-204	TI-224	PIC-221	TIC 324	PI-303	PI-310	PI-313	PI-320										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0000																				
0100																				
0200																				
0300						1360.00														
0400																				
0500																				
0600																				
0700																				
0800						1360.00														
0900																				
1000																				
1100																				
1200																				
1300																				
1400	25.00	0.16	36.00	61.00	-0.00	1343.00	10.30	0.00	15.00	7.50	70.00	10.50	100.00	0.50	1.30	0.00	7.00	0.30	0.00	95.70
1500																				
1600																				
1700																				
1800																				
1900																				

Steady State Values
Data Range #1

Data Pts	10	10	10	10	10	10	8	8	8	8	8	8	8	5	7	8	8	8	8	8
Total	597.50	11.30	10036.00	4526.00	-0.70	13511.00	120.06	84.00	117.10	53.00	557.00	154.30	910.00	285.40	182.00	-5.40	52.90	0.30	64.10	419.90
Mean	59.75	1.14	1003.60	452.60	-0.07	1351.12	15.10	10.50	14.64	7.30	69.63	19.29	113.63	57.08	26.11	-0.68	6.61	0.04	8.01	52.49
Maximum	74.00	1.23	1113.00	514.00	-0.03	2000.00	15.40	50.00	16.00	7.50	71.00	20.00	120.00	61.00	31.10	0.10	8.66	0.90	9.00	58.00
Minimum	57.00	0.82	816.60	366.00	-0.11	1300.00	11.00	6.20	14.30	7.00	67.00	18.50	83.00	50.84	20.60	-1.10	2.40	-0.50	6.90	46.70

Heat-up + Steady State Values
Data Range #2

Data Pts	18	19	19	19	19	19	17	17	17	17	17	17	17	14	16	11	17	11	17	17
Total	1161.20	18.26	19116.00	6844.00	-1.23	37328.00	261.40	153.00	245.10	155.10	1145.00	323.30	1883.90	734.50	561.10	-8.52	125.55	-1.60	155.25	975.20
Mean	62.17	0.56	1005.11	360.21	-0.06	1964.53	15.38	6.36	14.42	46.30	67.18	19.02	111.06	53.46	35.32	-0.56	7.37	-0.06	7.03	57.31
Maximum	74.06	2.23	1113.40	514.06	-0.03	3021.60	16.40	50.00	24.65	633.00	71.00	20.00	132.00	85.00	63.99	1.96	8.60	0.90	9.30	130.30

DATA SHEET 4
PAGE 4 OF 8

Test Number	T-13		Row 8	
Temperature	500 Deg F	Heat-up Start	25	
Time	12 Hours	Steady State Start	38	Range #1 d38..d50
Date of Test	9-AUG-89	Steady State Stop	50	Range #2 d25..d50
		Test End	111	Range #3 d25..d111

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
(Hours)	HIC-201	FI-202 (IWC)	TIC-304 (Deg F)	TI-224 (Deg F)	PIC-221 (IWC)	TIC-324 (Deg F)	PI-503 (PSIG)	PI-310 (PSIG)	PI-323 (PSIG)	PI-330 (PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
Minimum	60.00	0.45	600.00	32.00	-0.11	1960.00	14.00	1.00	14.00	6.20	64.00	18.50	83.00	24.00	13.70	-1.10	2.40	-0.50	6.90	48.70

Total Treatment Values
Data Range #3

Data Pts	30	29	29	29	28	60	20	30	26	26	26	26	26	44	46	48	48	48	48	48
Total	1557.00	22.32	19618.00	8366.60	-1.96	10630.00	315.00	116.30	365.00	809.60	1768.00	490.80	3025.00	770.90	612.30	46.40	341.40	117.40	432.70	4228.10
Mean	51.90	0.77	676.48	288.48	-0.07	1965.75	15.75	3.88	14.05	31.14	68.00	18.88	116.35	17.52	13.31	0.97	7.11	2.45	9.01	88.09
Maximum	74.00	1.23	1113.00	514.00	-0.03	2021.00	19.00	50.00	18.00	638.00	71.00	20.00	132.00	84.00	63.90	38.90	8.60	18.00	10.90	142.20
Minimum	25.00	0.31	21.90	35.60	-0.17	1955.00	14.00	0.00	14.00	0.00	64.00	18.50	83.00	0.10	1.10	-1.10	2.40	-0.50	6.90	48.70

11-Jun-90

DATA SHEET 4
PAGE 5 OF 8

Test Number	1-13		Run 8		
Temperature	500 Deg F	Heat-up Start	17		
Time	12 Hours	Steady State Start	26	Range 01 426..438	
Date of Test	9-AUG-89	Steady State Stop	38	Range 02 437..434	
		Test End	111	Range 03 437..411	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Inlet Duct	Powder Box	Exit Gas	Roof	Steam Heated Riser	Ship Mine	Aluminum Pipe	Ship Mine	Middle Wall	Shell Support Rack 1	Shell Support Rack 2	Clay Pipe	Clay Pipe	Shell Support Rack	Left Diffuser Bracket	Inlet Duct	Shell Support Rack 2	Clay Pipe
							Surface			Internal	Internal	Internal	External		External	External	Surface	Internal	Surface			Surface	Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	232	77	84	116	217	427	243	214	189	83	106	128	109	111	-14	190	181	165	253	150	177	114	135
100	304	98	114	138	340	510	305	298	250	153	156	185	189	170	57	274	236	219	328	207	245	158	214
200	367	139	158	166	375	597	379	346	338	250	223	278	251	233	186	345	334	304	425	272	325	249	284
300	398	155	195	195	399	646	408	399	363	360	268	322	305	272	137	393	305	363	456	315	351	314	335
400	421	188	[illegible]	218	410	675	428	377	381	341	295	341	338	299	165	414	414	401	483	343	367	349	357
500	454	210	253	246	442	700	469	404	410	409	332	382	378	344	194	453	467	469	502	385	399	407	400
600	450	210	257	257	422	687	458	415	404	372	338	379	388	346	201	453	455	455	498	389	388	393	401
700	473	265	287	277	462	734	501	438	453	406	376	425	437	386	232	503	488	484	545	438	435	426	447
800	516	311	319	299	492	743	525	475	488	434	307	463	454	416	248	538	519	517	570	471	467	460	485
900	546	346	346	319	526	763	545	501	485	460	433	487	486	445	265	562	546	546	592	499	492	483	512
1000	552	366	363	332	541	775	560	506	495	468	453	504	541	463	280	579	563	563	599	520	503	473	527
1100	561	364	378	344	542	778	570	518	508	474	463	508	511	474	292	589	571	580	606	535	515	466	541
1200	445	329	345	335	506	749	535	468	453	329	427	460	453	420	192	534	528	529	575	498	477	434	494
1300	429	367	364	350	543	746	559	484	418	317	455	475	483	436	171	574	559	563	556	534	504	477	534
1400	488	295	371	367	578	783	590	502	365	334	476	310	494	295	194	599	546	588	620	560	533	513	562
1500	496	325	324	382	606	787	669	483	357	357	432	247	470	218	214	612	591	603	638	577	549	542	579
1600																							
1700																							
1800																							
1900																							
2000	500	467	370	455	670	814	662	454	467	482	436	396	492	386	339	650	653	659	686	638	618	623	637
2100	601	482	333	463	680	823	664	463	485	497	450	422	509	418	357	660	656	662	686	640	629	632	646
2200	405	376	386	420	411	366	431	206	290	381	337	264	389	314	208	487	512	534	469	500	458	483	471
2300																							
2400																							
2500																							
2600																							
2700																							
2800																							
2900																							
3000																							
3100																							
3200	263	212	175	249	209	154	201	182	158	183	171	136	169	177	186	223	233	224	230	224	264	206	221
3300	263	207	175	243	206	155	197	189	162	183	175	144	170	181	188	218	229	219	228	219	259	204	217
3400	201	204	177	239	201	153	194	127	160	183	177	147	172	184	185	214	224	214	222	214	254	201	214
3500	200	201	177	233	198	158	189	124	161	188	175	149	172	186	189	207	217	208	214	207	249	196	206
3600	197	197	179	228	197	148	186	126	161	190	179	152	173	187	186	203	212	203	249	201	245	193	203
3700																							
3800																							

11-Jun-90

DATA SHEET 4
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Test Number	T-13		Row 8	
Temperature	500 Deg F	Heat-up Start	17	
Time	12 Hours	Steady State Start	26	Range 01 d26..d38
Date of Test	9-JAN-90	Steady State Stop	38	Range 02 d17..d38
		Test End	111	Range 03 d17..d111

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Flow Right Side	Diffuser	Inlet Duct	Powder Box Surface	Exit Gas	Roof	Steam Coated Riser Internal	Ship Mine Internal	Aluminum Pipe Internal	Ship Mine External	Middle Wall	Shell Support Rack 1 External	Shell Support Rack 2 External	Clay Pipe Surface	Clay Pipe Internal	Shell Support Rack Surface	Left Diffuser Bracket	Inlet Duct	Shell Support Rack 2 Surface	Clay Pipe Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
4000																							
4100																							
4200																							
4300																							
4400																							
4500																							
4600																							
4700	163	167	178	190	157	119	151	143	150	157	152	153	162	169	169	160	167	159	164	160	199	153	160
4800																							
4900																							
5000																							
5100																							
5200																							
5300																							
5400																							
5500																							
5600																							
5700																							
5800																							
5900	144	142	159	168	137	111	134	127	132	136	139	134	140	146	158	139	145	139	141	140	170	136	139
6000																							
6100																							
6200																							
6300																							
6400																							
6500																							
6600																							
6700																							
6800																							
6900																							
7000																							
7100																							
7200																							
7300																							
7400																							
7500																							
7600																							
[illegible]																							

Test Number	T-13		Run 8		
Temperature	500 deg F	Heat-up Start	17		
Time	12 Hours	Steady State Start	26	Range #1 d26..d38	
Date of Test	9-AUG-89	Steady State Stop	38	Range #2 d17..d38	
		Test End	111	Range #3 d17..d111	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Inlet Duct	Powder Box	Exit Gas	Roof	Steam Heated Riser	Ship Mine	Aluminum Pipe	Ship Mine	Middle Wall	Shell Support Rack 1	Shell Support Rack 2	Clay Pipe	Clay Pipe	Shell Support Rack	Left Diffuser Bracket	Inlet Duct	Shell Support Rack 2	Clay Pipe	
							Surface			Internal	Internal	Internal	External		External	External	Surface	Internal	Surface			Surface	Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
8000																								
8100																								
8200	122	122	135	143	117	96	113	110	112	114	117	113	116	122	130	117	123	118	117	117	140	117	117	
8300																								
8400																								
8500																								
8600																								
8700																								
8800																								
8900																								
9000																								
9100																								
9200																								
9300																								
9400																								

Steady State Values
Data Range #1

Data Pts	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	11	11	11	0
Total	4696	3295	3164	3347	5191	7018	5296	4379	4025	3718	4023	3809	4397	3544	2304	5358	5259	5293	5600	5009	5745	5586	5988	0
Mean	522	366	352	372	577	780	588	487	447	413	437	423	489	394	256	596	58.	588	622	557	522	509	544	ERR
Maximum	604	482	378	463	680	823	666	518	508	497	476	508	511	471	357	660	656	662	680	640	629	632	646	ERR
Minimum	429	295	320	319	506	745	535	454	357	317	427	247	453	210	171	534	520	529	575	498	458	434	471	ERR

Heat-up + Steady State Values
Data Range #2

Data Pts	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	16	0
Total	8311	4948	5054	5259	8750	12737	9012	7729	7301	6474	6524	6704	7726	6121	3630	8939	8736	8750	9660	7971	7605	7475	7926	0
Mean	463	275	281	292	486	708	501	429	406	360	362	372	464	346	202	497	485	486	537	443	480	467	496	ERR
Maximum	609	482	378	463	680	823	666	518	508	497	476	508	511	471	357	[illegible]	456	562	680	640	629	632	646	ERR
Minimum	212	77	80	116	207	427	243	214	185	83	106	120	109	111	-14	190	181	165	253	150	351	314	335	ERR

Total Treatment Values

11-Jun-90

DATA SHEET 4
PAGE 8 OF 8

Test Number	T-13		Run 8
Temperature	500 Deg F	Heat-up Start	17
Time	12 Hours	Steady State Start	26	Range #1 d26..d38
Date of Test	9-AUG-89	Steady State Stop	38	Range #2 d17..d38
		Test End	111	Range #3 d17..d111

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Inlet Duct	Powder Box	Exit Gas	Roof	Steam Heated Riser	Ship Rise	Aluminum Pipe	Ship Rise	Middle Wall	Shell Support Rack 1	Shell Support Rack 2	Clay Pipe	Clay Pipe	Shell Support Rack	Left Diffuser Bracket	Inlet Duct	Shell Support Rack 2	Clay Pipe	
							Surface			Internal	Internal	Internal	External		External	External	Surface	Internal	Surface			Surface	Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Data Pts	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	23	23	23	0
Total	10169	6776	6692	7372	10583	14189	10658	8693	8787	8171	8149	8180	8091	7787	5205	10907	10800	10765	11654	9953	9325	8764	9290	0
Mean	377	251	248	273	392	526	400	329	325	303	302	303	329	288	196	404	400	399	432	369	405	381	404	ERR
Maximum	604	402	378	463	600	823	666	518	508	497	476	508	511	471	357	668	656	662	600	648	629	632	646	ERR
Minimum	122	77	84	116	117	96	113	102	112	83	106	113	109	111	-14	117	123	118	117	117	170	136	139	ERR

DATA SHEET 1
PAGE 1 OF 1

①

Test Run T14
Test Duration 400° / 12 hrs.
Heat-Up Rate
Flash Chamber Temperature 400°F
Flash Chamber Interior

Date 8-11-89
Time

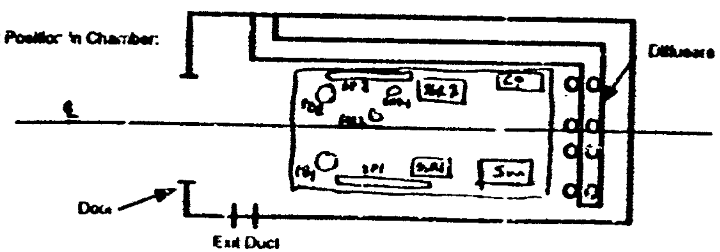
Test Start Date: Tues. 8-15-89
Test Stop Date: 8-18-89 FRIDAY

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. PB1	Explosives	[illegible]	8.0#	8.0#						[illegible]	
2. PB2		[illegible]	8.5#	8.5#						[illegible]	
3. SHR1		[illegible]	12.0#	11.5#							
4. SHR2		2' 9¼"	11.5#	12.0#							
5. SSR1		[illegible]	86.0#	86.0#						Good cond. h.	plastic melted
6. SSR2		[illegible]	85.5#	85.5#						Good condition	plastic melted
7. CP		[illegible]	97.0#	92.0#						[illegible]	large crack - [illegible]
8. SM			736#	740.5#						green color	[illegible]
9. SP1	[illegible]	[illegible]	20.5#	20.5#						[illegible]	
10. SP2		[illegible]	21.0#	21.0#						[illegible]	
11.											
12.											
13.											
14.											

177 057b

8-18-89
NOTE: Forgot to remove plastic covering over Spike area before the test. Plastic melted on SSR1 + 2. Took 4 Post Test wipes as planned. Will decide action after results come back.

Equipment Position in Chamber:



8-18-89 0945 - System Shutdown & Chamber door opened for end of T14

Chamber Temp 1002 98° [illegible]
66° [illegible]

0945 STARTED T.O., FIRING AFTERBURNER

DATA SHEET 2
PAGE 1 OF 4

TUES.
Date 8-15-89 Test Number T14 400°F / 12 hrs.

Time	Main Panel: Air Heater Inlet Damper HIC-201	Main Panel: Air Heater Inlet Air Flow PI-202 (in WC)	Main Panel: Air Heater Temperature TIC-204 (°F)	Main Panel: T.O. Inlet Air Temperature TI-204 (°F)	Main Panel: Bag. Pressure PIC-211 (in H2O)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-221 (°F)	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-306 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Afterburner: Burner Pressure PI-325 (PSIG)		Propane Tank: Quantity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	CEM: Air Heater Discharge THC (PPmv)	CEM: Flash Chamber Discharge THC (PPmv)	CEM: Afterburner Discharge THC (ppm)	CEM: Afterburner Discharge CO2 (%)	CEM: Afterburner Discharge CO (ppm)	CEM: Afterburner Discharge O2 (%)	CEM: Afterburner Discharge NOx (ppm)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100	0.0	-0.07	36	58	-0.10	0	486	32/64				6.1	2.2			70	20	48	3.0	3.2	2.3	13	12.3	18.1	2.1
1200																									
1300																									
1400	0.1	0.08	37	80	-0.09	0	495	49/63				16	0.5			73	20	102	2	2.2	1.4	13	18	51	83
1500	0.1	0.05	40	60	-0.07	0	538					18	0.3			74	20	102	0.4	2	1.5	1.9	18.5	13.9	1.7
1600	0.91	0.06	42	60	-0.11	0	811					15.4	2.4			76	20	104	0.4	2	2.8	2.0	21.7	6.2	[illegible]
1700	0.1	0.04	43	62	-0.07	0	1061	47/63				18.0	0.8			76	20	110	0.4	2	2.1	2.6	23.1	6.1	5.7
1800	2.1	-0.9	44	62	-0.1	0	1181					17.4	1.6			77	20	118	0.4	1.2	0.6	2.6	23	16	19.4
1900	2.1	[illegible]	43	62	-0.06	0	1437					18.4	1.0			77	19.5	116	0.4	1.2	0.4	4.4	1.3	12.7	34.6
2000	-0.1	0.04	40	61	-0.06	0	1660	16/61				16.8	2.7			77	20	112	0.4	1.2	0.0	4.2	0.3	8.3	15.6
2100	0.1	-0.05	18	60	-0.07	0	1771		18	0		19	1.7			76	20	109	0.7	1.2	0.0	3.7	0.3	12.7	15.1
2200	22.7	0.19	65	60	-0.08	0	1813		16	4.6		14.4	2.0			75	19.5	114	11.4	1.2	-0.2	5.5	1.2	12.2	47.4
2300	30.4	0.27	526	143	-0.05	0	1620		15.2	3.6		14.2	2.0			76	19	114	14.7		-0.3	7.8	-0.4	6.1	42.4

STARTED T.O. (1000)
3 HR HOLD (1100)
1 2 3 4 5 6 7 8 9 10 11 12
2200 STARTED T.O. SHUTDOWN PREHEATER
→ 2345

22:40 PREHEATER FLAMEOUT. RESTARTED IMM.
23:00 NOTED PROPANE ESCAPING FROM BLOWOFF - SHUT DOWN PREHEATER SYSTEM. RELIEVED PRESSURE BY CLOSING GAS VALVE & PUSHING PURGE START. AFTER RESTART PROPANE STILL ESCAPING - REPEATED SEQUENCE SEVERAL TIMES & SYSTEM BEGAN OPERATING NORMALLY - SET PREHEATER GAS VALVE TO 70% ON MANUAL.

Wednesday

DATA SHEET 2
PAGE 2 OF 4

②

Date 16 Aug 1989   Test Number T14 400°/12 hrs

Time	Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow (in WC)	Air Heater Temperature (°F)	T.O. Inlet Air Temperature (°F)	Bag. Pressure PIC 221 (in WC)	Bleed Air Valve Position HIC-22	T.O. Temperature (°F)	Ambient Conditions Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater Gas Pressure (PSIG)	Air Preheater Burner Pressure (PSIG)		Afterburner Gas Pressure (PSIG)	Afterburner Burner Pressure (PSIG)	
0000	55.1	0.78	422	238	-0.05	0	1965		15.6	3.1		14.6	7.0	
0100	50.0	0.66	863	270	-0.05	0	1956		15.6	2.2		14.1	7.2	
0200	47.9	0.66	860	287	-0.03	0	1970		16.0	1.9		13.9	7.2	
0300	[illegible]	1.18	945	317	-0.04	0	1787	68/59	16.0	2.2		14.0	7.0	
0400	[illegible]	1.17	951	328	[illegible]	0	[illegible]	71/61	15.9	2.5		14.0	7.1	
0500	[illegible]	[illegible]	[illegible]	327	-0.06	0	[illegible]	61/51	15.3	2.2		14.0	7.1	
0600	[illegible]	1.01	841	345	-0.05	0	1895	60/47	15.9	2.2		14.0	7.1	
0700	54.0	1.05	830	350	-0.06	0	1799	62/48	15.6	2.6		14.0	7.0	
0800	61.0	1.06	723	328	-0.06	0	1803		15.8	1.9		14.2	7.0	
0900	54.0	1.05	721	330	-0.01	0	1812	73/52	15.8	2.0		14.3	7.0	
1000	60.3	0.95	682	321	-0.05	0	1821		16.2	1.7		14.3	7.2	
1100	60.3	0.95	628	312	-0.04	0	1822	77/58	[illegible]	1.6		14.5	7.2	
1200	60.3	0.86	652	312	-0.04	0	1822	65/57	16.3	1.3		14.5	7.2	
1300	60.3	0.90	639	312	-0.08	0	925	81/62	[illegible]	1.3		14.4	7.2	
1400	39.9	0.34	33	234	-0.11	0	1012		—	—		15.4	6.9	
1500														
1600														
1700														
1800														
1900														
2000														
2100														
2200														
2300														

Time	Propane Tank Capacity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	CEM Air Heater Discharge THC (ON) (ppmv)	CEM Flash Chamber Discharge THC (OFF) (ppmv)	Afterburner Discharge THC	Afterburner Discharge CO_2 (%)	Afterburner Discharge CO	Afterburner Discharge O_2 (%)	Afterburner Discharge NO_x
0000		75	19	116	14.7		0.3	7.4	-0.4	8.9	45
0100		73	19	124	37.5		-0.3	7.8	-0.2	9.1	57.8
0200		72	19	122	31.5	30.1	-0.3	7.9	-0.4	8.6	48.5
0300		-	-	-		46.0	0.3	6.5	0.1	10.9	52.7
0400	-	68	17.8	123	61.8	44.0	-0.3	6.2	0.1	11.0	61.4
0500	-	-	-	-	~~[illegible]~~ 58.2	42.6	-0.3	6.7	-0.5	10.2	54.[illegible]
0600	-	68	18.8	122	64.2	43.2	-0.3	6.4	0.5	10.9	57.9
0700		68	18.8	123	64.0	41.9	0.4	6.5	-0.1	10.3	57.[illegible]
0800		66	18.5	121	47.2	36	-0.4	6.0	0.2	11.3	62.4
0900		66	18.8	132	40	36.8	-0.2	6.8	0.5	10.2	56.5
1000		68	17	128	34	28	-0.2	7.6	0.3	8.1	67
1100		68	17	126	30.5	25	0	7.6	0.2	8.2	66.[illegible]
1200		70	17	124	27	20.2	0.2	7.4	0.4	9.3	62
1300	302	70	17	124	26	19.2	-0.2	7.3	0.7	11.5	93
1400		72	15.5	128	8.0	14	-0.1	5.7	0.6	12.[illegible]	[illegible]
1500											
1600											
1700											
1800											
1900											
2000											
2100											
2200											
2300											

1400 END OF 400°/12 HR
SHUT DOWN PREHEATER.

0300 – Steady State reached – Exit Gas temp 410. °F

0301 – Flame Failure on A.H. – no apparent reason
restart 0302

0512 – High building press. alarm. CP temp. took off to +1000. °F
NO_x, CO, & THC put at ~0525 (CEM crat)

0735 – A.H. Flame out – back on at 0-36

0749 – A.H. Flame Failure again – not [illegible] try up again 07:50

DATA SHEET 2
PAGE 3 OF 4

(3)

Thursday
Date 17 AUG 1989 Test Number T14 700°/12 min

Time	Main Panel: Air Heater Inlet Damper HIC-301	Air Heater Inlet Air Press PI-307 (INWC)	Air Heater Temperature TIC-304 (°F)	T.O. Inlet Air Temperature TI-304 (°F)	Bldg. Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-334 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature	Air Preheater: Gas Pressure PI-308 (PSIG)	Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-327 (PSIG)	Burner Pressure PI-330 (PSIG)		Propane Tank: Capacity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	(EII) Air Heater Discharge THC (on) (PPMV)	Flash Chamber Discharge THC (off) (PPMV)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900	30.0	0.28	20	66	-.004	0	1911	86/57	—			14.6	7.3			67	19	122	0.4	1.2	0.2	6.7	0.4	10.2	101
1000	30.0	0.26	24	65	-0.07	0	1945	90/57	—			14.7	7.3			67	19	121	0.5	4	0.2	6.9	0	10.2	103
1100	30.0	0.24	27	65	0.05	0	1980	93/51	—			14.1	7.3		207	68	19.5	124	0.8	1.0	0.2	6.8	0	10.0	101
1200	30.0	0.21	[illegible]	69	-0.09	0	1950	89/61				14.6	7.3			70	19.5	121	0.4	1.0	0.2	6.6	0.1	10.2	99.8
1300	30.0	0.25	32	68	-0.09	0	1947	82/59	16.8	0.0		14.9	7.3			69	18.2	119	0.4		0.2	6.8	0.1	10.1	101.5
1400	30.0	0.28	29	67	-0.09	0	1951	82/55				14.9	7.3			70	19.2	123	0.3		0.2	6.8	0.2	10.1	105.8
1500	30.0	0.29	31	65	-0.09	0	1940	85/60				14.9	7.3			71	19.5	123	0.4	1.0	0.2	6.7	0.5	10.3	103
1600	30.0	0.29	34	66	-0.10	0	1955																		
1700																									
1800																									
1900																									
2000																									
2100																									
2200																									
2300																									

@1405 hrs. - major wind storm came through - ~70 mph winds
high building press. alarm

DATA SHEET 2
PAGE 4 OF 11

FRIDAY
Date 12 AUG 89 Test Number T14 400°F / 12 hrs.

Time	Main Panel: Air Heater Inlet Damper HIC-211	Air Heater Inlet Air Flow PL-202 (INWC)	Air Heater Temperature TC-204 (°F)	Y.D. Inlet Air Temperature TI-204 (°F)	B.B. Pressure TC-221 (INWC)	Bleed Air Valve Position HIC-22	T.X. Temperature TC-224 (°F)	Ambient Conditions, Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PL-208 (PSIG)	Air Preheater: Burner Pressure PL-210 (PSIG)		Afterburner: Gas Pressure PL-322 (PSIG)	Afterburner: Burner Pressure PL-330 (PSIG)		Propane Tank: Quantity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	CEM: Air Heater Discharge THC (on) (PPMV)	CEM: Flash Chamber Discharge THC (off) (PPMV)	CEM: Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
08[illegible]																									
0900	130	0.38	16	50	-0.4	[illegible]	1911	[illegible]7.2	45	[illegible]		.1	2.1			~1	19	45	— calibrating —		1.8	5.5	0.[illegible]	12.5	90
[illegible]																									
[illegible]																									
1200																									
1300																									
1400																									
1500																									
1600																									
[illegible]																									
18[illegible]																									
1900																									
2000																									
2100																									
2200																									
2300																									

0945 – System shutdown for end of Test T14 opened chamber door.

1005 – Noted that plastic on SSR was left on during the test. Plastic melted. Mike Cosmos advised to take 4 Post-Test wipes as usual & will discuss course of act[illegible]

DATE : 8-15-89 TUES. TEST : T14 400 °F / 12" hrs.

①

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
0830																														
0930																														
1030																														
1130																														
1230																														
1330	109	108	124	118	112	109	114	106	128	114	107	105	107	105	110	112	115	110	113	103										
1430	110	108	124	118	113	109	111	107	124	114	108	106	108	109	111	115	115	112	114	105										
1530	110	109	124	117	113	110	110	107	124	114	109	108	109	108	112	113	115	112	114	107										
1630	110	109	124	117	113	110	111	108	123	114	110	109	110	109	113	114	115	113	114	108										
1730	111	109	123	117	113	111	112	108	123	114	111	110	111	110	113	114	116	114	115	109										
1830	111	109	123	116	113	111	112	108	123	114	111	111	111	111	114	114	116	114	115	110										
1930	111	109	124	117	112	111	112	107	123	114	112	112	112	111	114	115	116	115	116	112										
2030	111	109	124	117	113	114	111	107	122	113	114	112	111	111	114	114	116	116	115	114										
2130	110	108	123	117	112	110	111	107	122	113	111	112	111	111	113	113	115	[illegible]	115	111										
2230	210	128	130	134	265	161	203	232	229	151	147	128	136	138	130	151	116	125	147	119										
2330	276	144	145	155	307	115	253	261	302	188	185	159	168	165	155	236	221	165	191	196										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

also got high building press. alarm at about the same time.

	Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		PB [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PB1	[illegible]	Exit Gas	[illegible]	[illegible]	SSR3	SHR1	SP2	SSR1	SP1	[illegible]	SM [illegible]	SM [illegible]	CP [illegible]	CP [illegible]										
0030		334	[illegible]	180	267	461	[illegible]	352	321	375	237	274	231	267	242	220	354	307	245	276	177										
0130		406	407	215	231	478	304	380	397	407	257	319	291	309	281	262	388	337	366	334	246										
0230		417	279	241	261	485	333	400	412	417	263	345	322	340	309	282	408	367	335	363	298										
0330		453	281	265	287	491	391	425	442	445	285	373	358	377	362	336	445	396	364	383	383										
0430		466	308	286	306	498	400	436	451	471	308	385	391	393	377	347	448	408	392	408	367										
0530		472	320	300	326	506	414	447	461	471	306	416	410	445	385	366	463	423	412	491	705										
0630	Ucl line out.	480	332	311	335	517	422	456	467	472	322	424	425	426	406	377	468	431	423	445	471										
0730		406	324	317	332	455	325	430	477	476	331	424	135	437	413	384	472	437	420	444	424										
0830		449	321	312	331	460	319	429	437	414	304	405	412	413	325	371	410	410	412	419	415										
0930		451	333	316	342	493	377	427	438	445	310	411	416	416	400	379	442	413	413	423	414										
1030		458	339	319	346	473	356	423	434	410	314	415	419	412	369	376	457	414	412	418	411										
1130		444	338	321	345	468	358	422	438	441	317	408	412	419	378	376	459	410	411	417	412										
1230		448	337	321	346	465	391	419	432	439	326	405	409	406	395	325	450	407	408	414	409										
1330		442	339	322	356	463	370	419	431	433	309	405	409	406	395	375	435	407	407	414	410										
1430		337	283	303	306	314	308	330	267	338	155	353	347	330	337	335	357	330	373	349	393										
1530			260		260			260	200	305	210	260	260	260	260	160	200				240										
1630																															
1730			250		250			240	190	260	190	240	250	250	250	240	250				240										
1830																															
1930			210		210	180			170	210	210	210	210	210	210	210	210				215										
2030			190		190	160			160	215	160	190	190	190	190	190	190				200										
2130																															
2230			175	190	165				185	210	170	170	115	180	165	170	170	180	180	180	180										
2330			160	180	155					200	155	160	160	170	155	165	165	170	160	160	160										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

0200 - Reached Steady State - Exit Gas Temp 410°F

1400 - [illegible] 400°/12 hr - Start Down Preheater

(3)

THOMSON 18 AUG 1989 T14 400° / 12 HRS

	Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		PB																													
		[illegible]	Floor	Right Wall	Left Floor	Center Diff	PB1	[illegible] Inlet	Exit Gas	Roof	Right Front	SSR2	SHR1	SP2	SSR1	SP1	Left Diff	M Ext	M Int	CP Ext	CP Int										
35	0030 (08:30)	135	125	144	133	116	126	132	116	161	133	129	127	133	126	136	136	132	131	129	125										
36	0130		155	170						190	150	150	155	160	155	150	150	160	160	160	150										
37	0230		150	165	155				160	180	155		155		155		155	150		150											
38	0330																														
39	0430		140	150	140	140				170	135	140	150	140		140	140			140	145										
40	0530									165	130	130	120	135	136	130	130	130	130	130	120										
41	0630																														
42	0730		125	150				125		160	120	125		125		120	120	120	120		110										
43	0830	[illegible]	125	149	133	116	136	132	116	161	133	129	127	133	126	136	136	132	131	129	125										
44	0930	135	124	148	134	118	126	132	116	160	136	129	127	134	125	134	136	133	13[illegible]	129	125										
45	1030	134	125	147	135	118	126	132	116	158	134	129	127	133	126	134	135	132	131	129	125										
46	1130	134	125	146	135	119	126	131	117	155	132	129	127	132	126	134	134	131	131	129	125										
47	1230	133	124	145	133	119	126	130	117	153	130	128	127	130	126	134	132	130	130	129	125										
48	1330	132	125	145	132	117	125	130	116	152	131	128	127	130	126	134	131	128	130	128	125										
49	1430	129	124	144	131	116	124	128	115	150	128	126	126	127	124	133	127	126	128	126	124										
50	1530																														
51	1630																														
52	1730																														
53	1830	120	120	140	120	120	120	140	120	120	120	120	120	110	120	120	120	120	120	120	120										
54	1930	115	115	135	115			115	115	135	115	115	115	115	115	115	115	115	115	115	115										
55	2030																														
56	2130	110	110	130	110			110	110	130	110	110	110	110	110	110	110	110	110	110	110										
57	2230																														
58	2330	108	108	125	108			108	108	125	108	108	108	109	109	108	108	108	108	108	108										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

[illegible]ay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
	[illegible]	Floor	[illegible]	Left Floor	[illegible]	PB1	[illegible]	[illegible]	Roof	[illegible]	SSR2	SHR1	SP2	SSR1	SP1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
0030	105	105	125	105			105	105	125	105	105	105	105	105	105	105	105	105	105	105										
0130																														
0230	100	100	120	120			110	110	120	100	100	100	100	100	100	100	100	100	100	100										
0330	95	95	115	95			95	95	115	95	95	95	95	95	95	95	95	95	95	95										
0430																														
0530																														
0630	95	95	115	95			95	95	115	95	95	95	95	95	95	95	95	95	95	95										
0730																														
0830	109	105	123	109	96	103	105	97	125	111	104	103	107	101	108	108	107	106	104	100										
093025	110	104	123	110	97	104	107	98	125	111	105	104	106	103	110	105	106	106	105	102										
1030																														
1130																														
1230																														
1330																														
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1530																														
1630																														
1730																														
1830																														
1930																														
2030																														
2130																														
2230																														
2330																														

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

18-Jun-90

DATA SHEET 4
PAGE 1 OF 6

Test Number	7-14		Row 8	
Temperature	600 Deg F	Heat-up Start	16	
Time	12 Hours	Steady State Start	32	Range #1 d12..d44
Date of Test	15-Aug-90	Steady State Stop	44	Range #2 d22..d44
		Test End	67	Range #3 d20..d67

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-101	FI-102	TIC-104	TI-224	PIC-222	TIC-324	PI-231	PI-310	PI-313	PI-330										
(Hours)		(INWC)	(Deg F)	(Deg F)	(INWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0					-0.10	452.00			10.60	0.30	70.00	26.00	98.00	1.00	3.30	2.30	1.30	17.30	18.10	7.90
100																				
200																				
300					-0.03	695.00			10.60	0.30	73.00	30.00	102.00	2.00	3.30	1.40	1.30	10.00	18.10	6.30
400					-0.06	556.00			18.00	0.30	71.00	30.00	102.00	9.40	3.00	1.50	1.40	13.50	17.90	9.40
500					-0.11	811.00			18.40	0.60	75.00	30.00	104.00	9.40	3.00	2.00	2.00	21.70	16.23	13.20
600					-0.00	1001.00			18.60	0.00	76.00	26.00	111.00	6.40	2.00	2.10	2.60	22.10	16.10	15.70
700					-0.10	1196.00			17.40	1.00	77.00	30.00	110.00	0.40	1.30	0.60	2.60	30.00	16.10	24.40
800					-0.08	1437.00			18.40	1.00	77.00	19.50	116.00	0.40	1.30	0.40	4.40	1.30	12.70	54.60
900					-0.06	1606.00			16.00	2.70	77.00	20.00	112.00	0.40	1.30	0.00	4.30	0.70	13.70	45.60
1000					-0.07	1791.00	18.00		18.00	1.70	76.00	20.00	109.00	0.40	1.30	0.00	3.70	0.00	12.70	43.30
1100	22.70	0.10	65.00	66.00	-0.08	1933.00	16.00	0.60	14.00	7.00	75.00	19.50	116.00	11.40	1.30	-0.30	5.50	1.30	13.30	47.50
1200	30.40	0.20	326.00	143.00	-0.05	1830.00	15.30	3.10	14.30	7.00	75.00	19.00	116.00	14.70		-0.30	7.06	-0.40	8.99	42.40
1300	56.10	0.70	932.00	238.00	-0.06	1905.60	15.30	3.10	16.30	7.00	75.00	19.00	116.00	14.70		-0.30	7.00	-0.40	8.90	42.00
1400	50.00	0.66	863.00	270.00	-0.05	1952.05	15.60	2.30	14.00	7.25	73.00	19.00	124.00	20.50		-0.30	7.00	-0.50	9.10	50.00
1500	49.30	0.66	860.00	281.00	-0.03	1970.00	15.90	1.90	14.40	7.30	73.00	19.00	127.00	20.50	30.10	-0.30	7.30	-0.10	8.60	68.50
1600	60.10	1.10	945.00	317.00	-0.04	1707.00	16.00	2.30	14.00	7.00					46.00	-0.32	6.50	-0.10	10.90	58.70
1700	60.30	1.10	861.09	320.00	-0.06	1795.00	15.40	2.50	14.30	7.10	60.00	18.00	123.00	61.00	44.00	-0.30	6.30	-0.10	11.00	62.30
1800	64.00	1.04	852.06	337.00	-0.06	1821.00	15.90	2.30	14.00	6.90				58.30	42.60	-0.30	6.70	-0.50	10.30	61.30
1900	64.60	1.04	848.00	345.60	-0.05	1843.00	15.90	2.30	14.00	6.30	60.00	18.00	122.00	64.20	43.30	-0.30	6.40	-0.50	10.90	54.90
2000	64.00	1.06	830.00	350.00	-0.05	1669.06	15.60	2.60	14.00	7.00	68.00	18.00	123.00	64.00	41.90	0.40	6.50	-0.10	10.30	53.00
2100	64.00	1.06	723.00	328.00	-0.06	1003.06	15.80	1.90	14.30	7.00	66.00	18.50	131.00	47.20	36.00	-0.30	6.00	0.20	11.30	52.40
2200	64.00	1.06	721.00	150.00	-0.37	1822.00	15.00	2.00	14.30	7.00	60.00	18.56	133.50	60.00	36.30	-0.20	6.00	0.20	10.30	56.50
2300	66.30	0.86	682.00	321.00	-0.05	1931.00	16.20	1.50	14.50	7.20	68.00	19.00	130.00	34.00	30.00	-0.30	7.60	0.30	9.10	65.10
2400	60.30	0.86	678.66	319.00	-0.04	1927.00	16.40	1.40	14.50	7.20	68.00	19.00	126.00	30.50	35.00	-0.20	7.60	0.73	9.20	66.20
2500	60.26	0.90	682.90	317.00	-0.04	1927.00	16.40	1.30	14.50	7.20	70.00	19.00	124.00	27.00	30.20	-0.30	7.40	0.60	9.30	63.10
2600	60.20	0.90	678.00	313.00	-0.05	1524.00	15.40	1.30	14.60	7.30	70.00	19.00	126.00	26.00	25.30	-0.20	7.30	0.70	9.50	63.30
2700	20.50	0.25	236.00	242.00	-0.11	2012.00			16.40	6.70	72.00	19.50	128.00	1.10	1.00	-0.10	5.70	0.66	12.00	103.60
2800						1950.00								1.10	1.00	0.10	5.40	4.20	12.10	88.40
2900														0.90	2.00	0.10	5.20	4.30	12.40	82.40
3000						1920.00								0.90	1.60	0.10	5.30	4.10	12.40	76.40
3100														0.00	1.50	0.10	5.20	4.00	12.40	73.70
3200						1900.00								0.50	1.50	0.10	5.10	3.70	12.50	70.40
3300						1896.00								0.40	1.40	0.10	5.10	3.50	12.50	69.20
3400														0.50	1.30	0.10	5.10	3.50	12.60	67.70
3500						1870.00								0.60	1.10	0.10	5.00	3.50	12.70	67.00
3600						1850.00								0.40	1.40	0.10	5.00	3.00	12.70	66.60
3700														0.40	1.40	0.10	5.00	4.00	12.70	65.40
3800						1850.00								0.50	1.30	0.10	4.90	3.00	12.80	62.00

Test Number	T-14		Run #		
Temperature	400 Deg F	Heat-up Start	28		
Time	12 Hours	Steady State Start	32	Range #1 432..444	
Date of Test	15-Aug-89	Steady State Stop	44	Range #2 428..444	
		Test End	87	Range #3 428..487	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	FIC-201	PI-232	TIC-304	TT-228	PIC-231	TIC-326	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000														0.40	1.20	0.10	4.00	3.00	12.90	62.10
4100						1030.00								0.30	1.10	0.10	4.00	3.30	13.00	61.50
4200						1020.00								0.50	1.00	0.10	4.00	4.10	13.00	61.40
4300														0.30	1.10	0.10	4.00	3.90	13.00	61.00
4400						1010.00								0.40	1.00	0.10	4.70	4.20	13.10	59.90
4500														0.40	1.50	0.10	5.00	4.30	11.50	70.10
4600	30.00	0.28		56.00	-0.07	1911.00			14.60	7.20	67.00	19.00	122.00	10.60	10.20	6.00	6.10	11.00	12.10	67.90
4700	30.00	0.26		60.00	-0.07	1905.00			14.70	7.30	67.00	19.00	121.00	0.60	1.60	11.10	4.00	7.40	9.90	133.00
4800	30.00	0.24		63.00	-0.05	1946.00			14.60	7.30	68.00	19.50	124.00	0.50	1.60	0.20	6.00	4.20	10.10	104.60
4900	30.00	0.27		63.00	-0.00	1950.00			14.00	7.20	70.00	19.50	121.00	0.70	1.30	0.20	6.70	3.70	10.30	99.30
5000	30.00	0.25		60.00	-0.09	1937.60	16.60	0.00	14.90	7.30	60.00	19.30	119.00	0.40	1.30	0.20	6.70	3.40	10.10	100.90
5100	30.00	0.28		67.00	-0.08	1951.00			14.90	7.30	70.00	19.30	122.00	0.40	1.20	0.20	6.30	3.50	11.70	79.60
5200	30.00	0.28		65.00	-0.08	1948.00			14.00	7.30	71.00	19.50	123.00	0.60	1.50	0.30	6.70	3.00	10.20	102.60
5300	30.00	0.28		66.00	-0.10	1955.00								0.70	1.50	0.20	6.70	3.00	10.20	103.00
5400														0.60	1.40	0.20	6.00	3.50	10.10	103.00
5500						1900.00								0.40	1.20	0.10	6.90	3.20	9.90	103.30
5600						1900.00								0.40	1.00	0.10	6.90	3.00	9.90	102.70
5700														0.50	0.90	0.10	6.90	2.90	9.90	102.20
5800						1960.00								0.30	1.00	0.10	6.90	2.90	10.00	100.70
5900														0.30	1.00	0.10	6.00	2.90	10.10	99.60
6000						1956.60								0.50	1.00	0.20	6.00	3.30	10.10	99.90
6100						1944.00								0.30	1.10	0.20	6.00	3.20	10.10	9.00
6200														0.40	1.00	0.20	6.00	3.10	10.10	98.00
6300						1940.00								0.30	0.90	0.20	6.00	3.10	10.20	97.60
6400						1920.00								0.40	0.80	0.10	6.00	2.90	10.20	96.20
6500														0.30	0.90	0.10	6.00	1.00	10.20	95.70
6600														0.30	0.90	0.10	6.00	2.00	10.25	94.70
6700						1920.00								0.40	0.90	0.10	6.70	2.90	10.30	94.20
6800														0.30	1.00	0.10	6.70	2.90	10.30	93.20
6900														7.70	1.10	0.20	6.60	3.00	10.40	91.50
7000	30.00	0.28		50.00	-0.08	1911.00	16.50	0.00	14.40	7.10	61.00	19.00	125.00			1.40	5.50	0.20	10.50	90.00
7100																				
7200																				
7300																				
7400																				
7500																				
7600																				

Test Number	T-14		Run 8
Temperature	400 Deg F	Heat-up Start	28
Time	12 Hours	Steady State Start	32
Date of Test	15-Aug-89	Steady State Stop	44
		Test End	87

Range 61 432..444
Range 62 420..444
Range 63 428..487

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	BIC-201	PI-202	TIC-304	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000														0.40	1.20	0.10	4.60	3.60	12.90	63.10
4100						1830.00								0.30	1.10	0.10	4.06	3.90	13.00	61.50
4200						1820.00								0.40	1.00	0.10	4.00	4.10	13.00	61.40
4300														0.30	1.10	0.10	4.00	3.90	13.00	61.00
4400						1810.00								0.40	1.00	0.10	4.70	4.20	13.10	58.90
4500														0.40	1.50	0.10	5.00	4.30	11.50	78.10
4600	30.00	0.20		66.00	-0.07	1911.00			14.60	7.20	67.00	15.00	122.06	10.60	10.20	6.40	5.10	11.00	12.10	67.90
4700	30.00	0.26		68.00	-0.07	1905.00			14.70	7.20	61.00	15.00	121.00	0.50	1.60	11.10	4.00	7.40	9.90	133.00
4800	30.00	0.24		65.00	-0.05	1946.00			14.60	7.30	68.00	15.50	124.00	0.50	1.60	0.20	6.00	4.20	10.10	104.60
4900	30.00	0.27		65.00	-0.08	1950.00			14.00	7.20	70.00	15.50	121.64	0.70	1.20	0.20	6.70	3.70	10.30	99.20
5000	30.00	0.25		68.00	-0.09	1947.00	16.60	0.00	14.90	7.30	69.30	15.20	119.00	0.40	1.30	0.20	6.70	3.40	10.10	100.90
5100	30.00	0.20		67.00	-0.30	1951.00			14.90	7.30	73.00	15.20	123.00	0.40	1.20	0.20	6.10	3.60	11.70	79.60
5200	30.03	0.20		65.00	-0.08	1940.00			14.00	7.30	71.00	15.50	125.00	0.60	1.50	0.30	5.70	3.06	10.25	102.65
5300	30.00	0.20		66.00	-0.10	1955.00								0.70	1.50	0.20	6.10	3.00	10.20	103.00
5400														0.40	1.10	0.20	6.00	3.50	10.10	103.00
5500						1900.00								0.10	1.20	0.10	6.90	3.20	9.90	103.30
5600						1900.00								0.40	1.00	0.10	6.90	3.00	9.90	102.70
5700														0.50	0.90	0.10	6.90	2.94	9.90	102.25
5800						1960.00								0.33	1.00	0.10	5.90	2.96	10.06	100.70
5900														0.30	1.00	0.10	6.00	2.90	10.10	99.60
6000						1950.00								0.50	1.00	0.20	6.00	3.20	10.10	99.90
6100						1940.00								0.30	1.16	0.20	6.00	3.20	10.10	9.06
6200														0.40	1.00	0.20	6.50	3.10	10.10	98.00
6300						1940.00								0.38	0.90	0.20	6.50	3.10	10.30	97.60
6400						1930.00								0.46	0.56	0.16	5.56	3.90	10.25	96.20
6500														0.30	0.90	0.10	6.00	1.60	10.30	95.70
6600														6.30	0.50	0.10	6.00	2.00	10.20	94.70
6700						1920.00								0.40	0.90	0.10	6.70	2.90	10.30	94.20
6800														0.30	1.00	0.10	6.76	2.96	10.30	93.20
6900														7.70	1.10	0.20	6.60	3.40	10.40	91.50
7000	30.00	0.20		50.00	-0.08	1911.00	15.50	0.00	14.40	7.10	61.00	15.00	125.00			1.06	5.50	0.20	10.56	96.00
7100																				
7200																				
7300																				
7400																				
7500																				
7520																				

Test Number	T-14		Run 8		
Temperature	600 Deg F	Heat-up Start	27		
Time	12 Hours	Steady State Start	30	Range #1 430..442	
Date of Test	15-AUG-85	Steady State Stop	42	Range #2 427..442	
		Test End	65	Range #3 427..465	

Elapsed Time	Rear Diffuser Bracket	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Powder Box	Diffuser Bracket Inlet	Exit Gas	Roof	Middle Wall	Shell Support Rack 2	Steam Heated Riser	Steel Pipe 2	Shell Support Rack 1	Steel Pipe 1	Diffuser Bracket Left Wall	Ship Bias	Ship Bias	Clay Pipe	Clay Pipe
					Surface						Surface	External	Internal		Internal		Surface	Internal	Surface	Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	106	108	124	118	112	109	111	106	124	114	107	106	107	106	110	112	115	116	113	103
100	110	108	124	118	113	109	111	107	124	114	120	106	108	107	111	113	115	112	114	105
200	118	120	124	117	113	110	111	107	124	114	160	160	108	108	112	113	115	112	114	107
300	118	109	124	117	113	118	111	108	123	114	110	109	110	109	113	114	115	113	114	108
400	111	108	123	117	113	111	112	108	123	114	111	116	111	110	113	114	116	114	115	109
500	111	108	123	116	113	111	112	108	123	114	111	111	111	111	114	114	116	114	115	110
600	111	108	124	117	113	111	112	107	123	114	112	112	112	111	114	115	116	115	116	112
700	111	109	124	117	113	111	111	107	122	113	111	112	111	111	114	114	116	116	115	111
800	116	140	123	117	112	110	111	107	122	113	111	112	111	111	113	113	115	114	115	111
900	210	128	130	134	263	161	203	230	229	154	141	120	136	130	130	181	176	126	147	118
1000	276	140	145	156	317	196	253	301	302	168	185	159	166	169	166	236	211	165	191	146
1100	374	200	180	207	464	276	352	369	316	237	272	230	267	248	230	354	307	265	276	177
1200	406	227	215	230	470	304	300	300	464	257	319	301	300	301	263	300	337	306	334	246
1300	417	240	241	251	465	333	400	433	417	263	345	322	340	300	323	400	367	336	363	300
1400	408	287	265	287	481	301	425	442	445	306	373	360	377	362	326	445	306	364	363	333
1500	466	303	256	306	490	400	436	454	471	300	306	301	303	377	347	440	400	304	466	368
1600	477	320	300	320	505	414	447	469	471	306	416	410	416	385	366	463	433	418	454	405
1700	400	320	311	335	517	422	456	467	472	322	424	426	426	405	377	466	431	423	445	471
1800	400	324	317	332	455	385	430	477	470	320	420	436	437	413	384	472	437	430	444	434
1900	440	321	312	331	450	359	420	437	444	366	405	412	413	385	371	440	410	412	419	413
2000	451	333	316	348	413	350	427	438	443	310	411	416	416	400	377	442	413	413	423	414
2100	450	330	319	346	413	336	423	434	440	314	410	414	412	399	376	437	411	412	418	411
2200	449	330	321	345	464	356	422	430	441	317	400	412	400	398	376	430	410	411	417	412
2300	441	337	321	346	465	301	419	430	439	306	405	400	406	395	375	436	407	400	414	400
2400	442	330	322	346	463	330	419	424	433	309	405	400	406	395	375	436	407	407	414	410
2500	337	282	283	306	314	300	336	264	330	255	333	367	330	330	336	367	330	293	340	303
2600		250		250			260	220	305	210	260	260	260	260	260	300				258
2700																				
2800		250		250			240	190	260	190	240	250	250	250	240	250				240
2900																				
3000		210		210				170	210	210	210	210	210	210	210	210				215
3100		190		190				160	215	160	190	190	190	190	190	190				200
3200																				
3300		175	190	165				185	210	170	170	175	180	165	170	170	180	180	180	180
3400		160	180	155					200	155	150	160	170	155	165	155	170	160	160	160
3500	126	125	140	133	116	130	132	136	161	133	128	127	133	126	136	136	132	131	128	125
3600		165	170						150	150	150	155	160	155	150	156	160	160	160	150
3700		150	165	156				160	136	155		155		155		155	150		150	
3800																				
3900		146	150	160	142				170	135	140	156	145		160				144	145

DATA SHEET 4
PAGE 5 OF 6

Test Number	T-14		Run 8		
Temperature	600 Deg F	Heat-up Start	27		
Time	12 Hours	Steady State Start	30	Range #1 d30..d42	
Date of Test	15-AUG-88	Steady State Stop	42	Range #2 d27..d42	
		Test End	85	Range #3 d27..d85	

Elapsed Time	Rear Diffuser Bracket	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Powder Box	Diffuser Bracket Inlet	Exit Gas	Roof	Middle Wall	Shell Support Back 2	Steam Heated Riser	Steel Pipe 2	Shell Support Back 1	Steel Pipe 1	Diffuser Bracket Left Wall	Ship Riser	Ship Riser	Clay Pipe	Clay Pipe
						Surface					Surface	External	Internal		Internal		Surface	Internal	Surface	Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
4000									155	129	130	130	135	135	130			130	128	130
4100																				
4200		125	150				125		160	130	125		125		130	130	130	130		110
4300	126	125	140	133	116	126	132	115	161	133	130	127	133	126	135	136	132	131	128	126
4400	126	124	146	134	118	126	132	116	160	136	130	127	134	125	134	136	133	131	129	125
4500	134	125	147	135	118	126	132	116	158	134	129	127	133	126	136	135	132	131	129	125
4600	134	124	146	136	119	125	131	117	155	132	129	127	132	126	134	134	131	131	129	125
4700	133	124	145	133	119	126	130	117	153	130	128	127	130	126	134	132	130	130	129	125
4800	132	125	145	132	117	125	130	116	152	131	128	127	130	126	134	131	129	130	128	125
4900	129	124	144	131	116	124	128	115	150	128	126	126	127	124	133	129	126	128	126	124
5000																				
5100																				
5200																				
5300																				
5400																				
5500																				
5600																				
5700																				
5800																				
5900																				
6000																				
6100																				
6200																				
6300																				
6400																				
6500																				
6600																				
6700	100	106	125	106	96	103	105	97	125	111	104	103	107	101	106	108	107	105	104	100
6800	110	104	123	110	97	104	107	98	125	111	105	104	106	103	110	108	106	106	105	102
6900																				
7000																				
7100																				
7200																				

Test Number	T-14		Run #	
Temperature	400 Deg F	Heat-up Start	27	
Time	12 Hours	Steady State Start	30	Range #1 430..442
Date of Test	15-AUG-88	Steady State Stop	42	Range #2 427..442
		Test End	85	Range #3 427..465

Elapsed Time	Rear Diffuser Bracket	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Pumper Box	Diffuser Bracket Inlet	Exit Gas	Roof	Middle Wall	Shell Support Rack 2	Steam Heated Riser	Steel Pipe 2	Shell Support Rack 1	Steel Pipe 1	Diffuser Bracket Left Wall	Ship Rine	Ship Rine	Clay Pipe	Clay Pipe	
						Surface					Surface	External	Internal		Internal		Surface	Internal	Surface	Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Steady State Values																					
Data Range #1																					
Data Pts	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	0
Total	5713	4142	3534	4208	6047	5436	5463	5583	5732	3342	5153	5179	5100	4973	4677	5648	5240	5192	6138	5462	0
Mean	440	316	303	324	464	397	420	428	441	303	397	398	390	383	360	436	403	399	415	420	[illegible]
Maximum	448	330	322	346	517	422	456	477	478	331	429	436	437	413	384	472	437	430	491	706	[illegible]
Minimum	337	143	311	261	314	308	330	264	328	255	333	322	330	300	252	367	330	336	340	298	[illegible]
Heat-up + Steady State Values																					
Data Range #2																					
Data Pts	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	0
Total	6776	4678	4474	4818	7343	6005	6446	6612	6811	4624	6036	5868	5824	5665	5314	6667	6095	5908	6130	6031	0
Mean	423	292	280	301	458	383	403	415	426	289	371	367	370	344	332	417	381	369	387	377	[illegible]
Maximum	448	330	322	346	517	422	456	477	478	331	429	435	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Minimum	236	140	145	156	314	186	253	264	302	186	185	150	140	160	156	236	211	165	191	146	[illegible]
Total Treatment Values																					
Data Range #3																					
Data Pts	26	26	32	34	27	26	29	32	37	37	36	36	36	36	36	36	36	34	32	36	0
Total	9060	7430	6890	7630	8515	7611	8332	8651	10578	7646	8946	8815	9009	8549	8302	9642	8133	7913	8156	9312	0
Mean	348	286	216	225	315	270	287	277	286	206	249	248	250	244	233	276	262	255	261	250	[illegible]
Maximum	448	330	322	346	517	422	456	477	478	331	435	436	437	413	384	472	437	430	491	705	[illegible]
Minimum	100	104	123	108	96	103	106	99	125	111	104	103	106	101	108	108	106	106	104	100	[illegible]

TEST RUN 15
600°F/12 HOURS

DATA SHEET 1
PAGE 1 OF 1

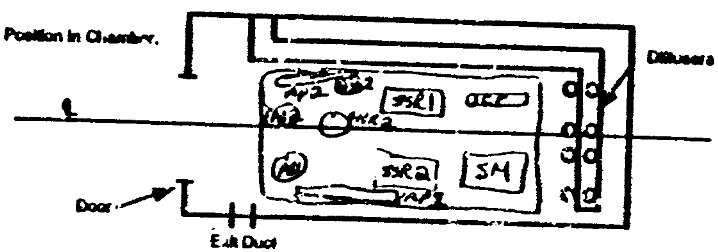
Test Run T15
Test Duration 12 hrs. - Steady State
Heat-Up Rate
Flash Chamber Temperature 600°F   Flash Chamber Interior

Test Start Date Tues.
Date 8/22/89
Time

	Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt. (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration ✓	Final Contaminant Concentration	Thermocouple #	Observations Pre Test	Observations Post-Test
1.	PB1	Explosives	16"x11"	10.5#	10.5						large crack around the ...	
2.	PB2	↓	16"x11¾"	10.5#	10.5						one side damaged in ...	
3.	SHR1		7¾x9½"	11.5#	11.5							
4.	SHR2		7"x9¾"	11.5#	11.5						good condition	
5.	SSR1		[illegible]	85.5#	85.5						Good Condition	
6.	SSR2		[illegible]	72.0#	72.0						short	
7.	AP1		5'x8"x[illegible]	5.5#	5.5						All	
8.	AP2		5'x8"x[illegible]	5.5#	5.5							
9.	CP		97½"	93.5#	94.5						shipping labels	
10.	SM			730#	724.0						most of [illegible] broken	
11.												
12.												
13.												
14.												
15.												

177-067a

Equipment Position in Chamber.



8/21/89 1210 - 1330 - Pre Test Sampling
1410 spiked equipment

8/22/89 0930 - Chamber loaded & thermocouples wired to equipment. CEM not calibrated yet - need ~1 hr. more.

9/27/89 Flash Chamber was sampled at the right hand wall, [illegible] west of the [illegible]

①

DATA SHEET 2
PAGE 1 OF 3

Tuesday

Date 8/22/89 Test Number T15 600° F / 12 hrs.

Time	Skid Panel: Air Heater Inlet Damper	Air Heater Inlet Air Flow (INWC)	Air Heater Temperature (°F)	T.O. Inlet Air Temperature (°F)	Bag Pressure (INWC)	[crossed out]	T.O. Temperature (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure (PSIG)	Air Preheater: Burner Pressure (PSIG)		Afterburner: Gas Pressure (PSIG)	Afterburner: Burner Pressure (PSIG)
0000													
0100													
0200													
0300													
0400													
0500													
0600													
0700													
0800													
0900													
1000													
1100													
1200	0.0	[illegible]	29	54	-.43	0.0	483	52/61	15.2	0		18.6	0.2
1300	[illegible]	[illegible]	32	54	-.42	0.0	498	[illegible]	15.4	0		[illegible]	0.0
1400	[illegible]	[illegible]	36	54	-.42	0.0	578		15.4	0		17.0	0.2
1500	0.0	[illegible]	37	54	-.46	0.0	506		15.0	0		19	0.2
1600	0.0	[illegible]	37	54	-.41	0.0	615	[illegible]	15.8	2		[illegible]	0.9
1700	0.0	[illegible]	40	56	-.44	0.0	740	[illegible]	15.4	0		[illegible]	0.5
1800	0.0	[illegible]	41	55	-.46	0.0	967		15.4	0		16.6	2.6
1900	0.0	[illegible]	38	53	-.51	0.0	1212	31/62	14.6	0		17.6	1.8
2000	0.0	[illegible]	35	52	-.53	0.0	1361	31/42	14.4	0		18.1	0.7
2100	0.0	-0.07	33	51	-.52	0	1467	31/57	14.2	0		16.6	1.8
2200	[illegible]	[illegible]	31	52	-.43	0	1847	31/55	14.1	0		15.4	5.0
2300	[illegible]	[illegible]	29	52	-.46	0	2046	31/53	14.1	0		15.5	5.0

Time		Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (on) PPMV	Flash Chamber Discharge THC (off) PPMV	Afterburner Discharge THC (ppmv)	CO_2 (%)	CO (ppmv)	O_2 (%)	NO_x (ppmv)
0000												
0100												
0200												
0300												
0400												
0500												
0600												
0700												
0800												
0900												
1000												
1100												
1200			69	21	102	1.0	1.2	1.0	1.4	177	17.7	9.0
1300			70	21	102	1.0	1.3	0.8	1.3	[illegible]	17.7	8.0
1400			70	21	102	1.0	1.2	0.7	1.2	17	17.7	8.1
1500			72	21	102	0.8	1.2	0.7	1.2	12.1	17.7	8.2
1600			73	21	[illegible]	0.6	1.2	0.4	1.6	[illegible]	[illegible]	[illegible]
1700			73	21	111	0.6	1.2	[illegible]	1.4	[illegible]	16.7	13
1800			74	20.5	118	0.5	1.2	1.8	2.3	2.5	16.2	[illegible]
1900			74	21	[illegible]	0.5	1.0	0.5	2.8	2.0	14.3	31
2000			75	20	104	0.5	1.0	0	2.4	[illegible]	16.1	15
2100			73	19.5	105	0.5	—	0.4	11.2	2.1	11.4	57.5
2200			72	19.5	121	0.5		0.5	5.6	0.2	12.5	42.5
2300			72	19.5	110	0.4		0.5	6.3	0.1	9.9	110

1100 - T.O. burner ignited
12.00 START 3 hr Hold at 500°F
15 00 START T.O. TEMP RAMP

NOTE: S.C. sealed the Chamber door w/ fiberglass. Seem to be alot better. Can hold Bldg. press. more negative & still get the temp. we need.

(2)

DATA SHEET 2
PAGE 2 OF 3

Wednesday
Date 8/23/89 Test Number T15 600°F / 12 hrs.

Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202 (INWC)	Air Heater Temperature TIC-201 (°F)	T.O. Inlet Air Temperature TI-201 (°F)	Disp. Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-201 (°F)	Air Inlet Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure (PSIG)	Air Preheater: Burner Pressure (PSIG)		Afterburner: Gas Pressure (PSIG)	Afterburner: Burner Pressure (PSIG)		Propane Tank: Capacity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (ON) (ppmv)	Flash Chamber Discharge THC (OFF) (ppmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000	65.0	1.02	772	187	-0.05	0	1922	76/54	16.0	3.0		14.5	7.2			73	19	95	90.0	..	-0.4	7.0	-.1	7.7	[illegible]
0100	65.0	1.05	822	284	-0.04	0	1992	81/61	15.7	2.6		14.5	7.2			72	19	87	47.5	—	-0.6	1.1	0	7.8	[illegible]
0200	65.0	1.01	916	310	-0.05	0	2003	73/55	15.6	3.0		14.5	7.2			71	19	83	56.8	—	-0.5	1.7	0.2	7.6	[illegible]
0300	65.0	1.02	920	330	-0.10	0	1970	72/51	16.2	2.3		14.9	7.2			70	19	71	—	34.7	0.4	1.0	-.1	7.1	[illegible]
0400	65.0	1.01	1021	354	-0.09	0	1922	70/55	15.6	3.9		14.5	7.3			69	19	70	56.7	39.0	0.5	9.1	0.0	[illegible]	[illegible]
0500	65.0	1.01	1067	387	-0.05	0	2017	66/61	15.8	4.5		14.9	7.3			69	19	66	50.0	22.5	0.7	7.7	0.1	[illegible]	[illegible]
0600	65.0	1.01	1160	581	-0.12	0	1987	66/51	15.2	4.7		14.9	7.3			69	17	62	52.0	19.3	0.6	7.0	0.2	[illegible]	[illegible]
0700	65.0	1.00	1108	416	-0.11	0	1991	63/55	15.3	4.4		14.9	7.3			69	19	67	—	22.2	0.5	7.1	0.2	[illegible]	[illegible]
0800	65.0	1.01	1099	425	-0.12	0	2002	72/56	[illegible]	4.7		14.9	7.3			69	19	72	42.0	23.0	0.7	8.4	0	[illegible]	[illegible]
0900	65.0	0.99	1116	436	-0.04	0	2007		15.2	4.5		14.9	7.3			69	19	76		20.7	0.4	2.0	0	7.0	[illegible]
1000	65	0.99	1108	448	-0.10	0	2011	75/69	15.2	4.6		15.6	7.2			69	19	78	CALIBRATION						
1100	65	0.99	1159	449	-0.03	0	[illegible]	90/65	15.2	4.5		14.6	7.0			69	19	72		16.6	0.3	9.1	0.1	6.7	[illegible]
1200	65	1.01	1131	459	-0.06	0	2027		15.0	4.7		14.9	7.3			69	19	76		18.8	0.5	8.9	.1	[illegible]	[illegible]
1300	63.[illegible]	1.03	1100	435	-0.1	0	2009	76/68	15.6	4.0		14.9	7.8			74	19	80	34.9	14.6	0.4	6.8	0.0	7.2	58
1400	63.7	1.02	113[illegible]	457	-0.09	0	2046		15.1	3.8		14.8	7.0			70	19	88		13.5	0.4	8.3	0.3	[illegible]	[illegible]
1500	63.9	1.02	1136	465	-0.1	0	1972		14.9	4.3		15.0	7.0			70	19	86		16.2	0.4	8.6	0.1	4.1	[illegible]
1600																									
1700							2013																		
1800							2030																		
1900																									
2000							2013																		
2100							2030																		
2200																									
2300							2024																		

8/22/89 #2329 A.H. burner ignited

0308 – High Building Press. alarm
C.? went off – partial on 1000°F scale

1255 hrs – Flame out on Pre heater (high temp of 1145°F)
1257 hrs – System back on

1430 – STEADY STATE CONDITIONS

DATA SHEET 2
PAGE 3 OF 3

Date 8/24/89 Test Number T-15 600°F/12 hr.

Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202 (in WC)	Air Heater Temperature TIC-204 (°F)	T.O. Inlet Air Temperature (°F)	Stag. Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure (PSIG)	Afterburner: Burner Pressure (PSIG)		Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (PPmv)	Flash Chamber Discharge THC (PPmv)	Afterburner Discharge THC (ppmv)	CO_2 (%)	CO (ppmv)	O_2 (%)	NO_x (ppmv)
0000																									
0100							2010																		
0200	67.1	.06	1129	541	-0.15	0	1992	57/47	150	4.7		150	6.0			62	19	58	35.6	41.4	0.5	9.2	0.4	6.6	54.6
0300																									
0400							1990																		
0500																									
0600																									
0700																									
0800							1980																		
0900																									
1000	13.3	0.34	10	153	-0.14	0	1986	70/55	20	0.0		145	7.0			60	19	110	0	1.1	0.5	5.6	0.3	11.0	24
1100																									
1200																									
1300							1980																		
1400	123	0.34	20	149	-0.13	0	1995		20.4	0		150	6.6			62	19	114	0.6		0.6	7.1	0.2	9.4	103
1500																									
1600																									
1700																									
1800							1980																		
1900																									
2000																									
2100																									
2200							1980																		
2300																									

Date. 8-22-84 TEST: 115 600 F / 12 hrs.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB							[illegible] Int.	[illegible]	Int.	top	top	[illegible]	Int.	Int.	Int.	[illegible]	out.	Int.	Int.										
	Diffusion					Roof	Exit Gas	[illegible]	[illegible]	AP 2	SSR1	SSR2	Roof [illegible]	AP1	SHR1	CP	Inlet [illegible]	CP	SM	SM										
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
0830																														
0930																														
1030	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓										
1130	104	105	115	103	105	104	107	96	100	94	101	93	95	101	92	103	104	98	96	105										
1230	103	102	113	105	103	103	106	98	100	97	101	97	98	100	98	102	103	95	99	103										
1330	102	101	113	105	103	102	106	99	100	99	101	99	99	101	99	102	102	98	100	103										
1430	103	101	112	106	103	102	105	100	100	100	101	100	100	101	100	102	102	99	101	103										
1530	102	100	112	103	103	102	105	100	99	101	101	101	101	101	100	102	102	100	102	103										
1630	102	100	111	103	102	102	104	101	100	101	101	101	101	101	101	102	102	101	102	103										
1730	102	100	111	104	103	102	105	101	99	102	102	101	102	101	101	102	102	102	103	104										
1830	103	101	112	104	103	103	105	102	100	102	102	102	103	101	101	102	102	103	103	104										
1930	102	100	111	103	102	102	104	102	99	102	102	102	102	100	[illegible]	102	101	103	103	104										
2030	101	99	111	103	102	101	104	101	99	102	101	103	102	99	101	101	101	103	103	103										
2130	101	100	110	103	101	101	104	101	98	102	101	101	102	99	101	101	101	103	102	103										
2230	101	100	110	103	101	101	103	101	98	102	101	101	102	99	101	110	110	103	[illegible]	107										
2330	[illegible]	124	115	127	225	200	225	109	225	106	116	108	117	135	104	218	240	103	106	148										

177 857

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

Date: Wednesday 8/23/89 Test: T15 600°F / 12 hrs.

2)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
	Diffusor					Roof	EXIT	PB2	Air	PB2	SSR1	SSR2	Roof Bracket	AP1	SHR1	CP		SP	SM	SM										
0030	555	190	264	208	390	318	350	223	361	221	259	237	235	297	222	347	579	162	208	291										
0130	425	245	219	276	461	383	392	318	426	284	356	281	312	357	288	419	450	246	298	363										
0230	466	266	263	319	497	421	429	549	461	350	376	344	365	393	337	462	499	323	465	411										
0330	501	320	288	356	532	463	455	521	491	515	415	382	403	417	367	470	519	477	427	443										
0430	535	358	329	393	566	483	486	424	527	433	452	422	446	444	406	520	554	444	487	477										
0530	570	407	344	428	602	521	514	462	537	473	451	451	480	465	443	547	593	469	504	511										
0630	589	485	509	454	621	546	535	490	581	504	505	488	506	489	466	570	611	504	507	535										
0730	600	465	405	468	628	[illegible]	546	568	585	525	521	504	524	486	481	590	617	525	550	544										
0830	614	476	427	411	645	574	560	529	590	545	540	526	543	505	501	608	636	549	567	566										
0930	624	488	441	504	644	581	563	591	602	555	549	536	551	524	512	608	612	563	577	575										
1030	632	507	463	517	651	590	574	565	607	566	558	547	565	525	523	651	650	572	587	584										
1130	645	514	466	524	660	600	584	583	618	590	569	557	575	534	534	634	658	529	602	592										
1230	648	528	476	531	671	609	592	587	598	584	574	565	581	537	559	637	660	597	607	600										
1330	655	523	480	541	656	609	593	569	574	[illegible]	574	566	582	540	539	673	667	600	606	577										
1430	657	539	491	556	669	617	602	578	632	596	584	574	593	549	548	641	675	607	615	608										
1530	610	555	501	[illegible]	680	555	[illegible]	660	[illegible]	[illegible]	[illegible]			555	595		660	620	650	630										
1630	670	620	515		610					640				560	560		620	640	660	640										
1730	670	560	515		690					640				560	560		620	640	660	640										
1830	700	570	525		700					645				570	570		700	645	680	645										
1930																														
2030	710	605	545		710					660				600	600		710	660	710	660										
2130	720	620	560		720					665				620	620		720	665	720	665										
2230																														
2330	725	630	560		725					680				630	630		725	680	725	680										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

DATE 8/24/89 TEST T-15 600 F / 12 hr.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB												[illegible]		4	4		4	4	4										
						[illegible]	[illegible]	PB		AP6	[illegible]	[illegible]	[illegible]	AP1	SHR	CP		CP	SM	SM										
0030																														
0130	135	159	570		135					1401	( )			656	650		135	180	135	740										
0230	737	150	605	617	757	118	654	175	707	118	175	[illegible]	157	617	613	732	744	596	771	704										
0330																														
0430	505	44			430		520		340	500		500		716	503	150		550	570	500										
0530																														
0630																														
0730																														
0830	320	260			270		340		345	324		310		245	320	210		320	310	310										
0930	323	241	315	281	270	301	362	334	264	331	317	330	311	248	324	273	304	334	316	321										
1030																														
1130																														
1230																														
1330	150	110	150				195	150	210	150	150	150	200	100	150	110	250	250	230	250										
1430																														
1530																														
1630																														
1730																														
1830	210	170	210	210		210	165	210	180	210	210	210	210	180	210	190	210	210	190	210										
1930																														
2030																														
2130																														
2230	180	170	180	180		180	230	180	150	120	150	180	180	150	130	160	180	180	180	180										
2330																														

Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

177 857c

1420 End Steady State on T-15

T-15 Cool Down Complete @ 0730 hrs 8/27/89

Test Number	T-15		Run 0
Temperature	696 Deg F	Heat-up Start	28
Time	12 Hours	Steady State Start	44	Range 01 444..456
Date of Test	22 Aug 88	Steady State Stop	56	Range 02 428..456
		Test End	133	Range 03 428..4133

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	AIC-301	PI-302	TIC-304	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INH2O)	(Deg F)	(Deg F)	(INH2O)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0					-0.43	453.00	15.20	0.00	18.60	0.20	68.00	21.00	102.00	1.00	1.30	1.00	1.40	17.70	17.70	9.00
100					-0.42	458.30	15.40	0.00	15.64	0.00	70.00	21.00	104.00	1.00	1.30	0.00	1.30	17.40	17.70	9.00
200					-0.42	513.60	15.20	0.06	18.00	0.20	70.00	21.00	102.00	1.00	1.20	0.70	1.20	17.00	17.70	8.40
300					-0.41	506.00	15.20	0.00	18.00	0.20	72.00	21.00	102.00	0.60	1.30	0.70	1.30	17.20	12.70	8.20
400					-0.43	615.00	16.50	0.00	18.56	0.40	73.00	21.00	108.00	0.50	1.30	1.40	1.60	20.00	17.10	12.00
500					-0.42	740.00	15.40	0.00	18.66	0.50	73.00	21.00	111.00	0.50	1.20	2.00	1.90	22.00	16.70	13.00
600					-0.45	967.00	15.40	0.00	18.60	0.60	74.00	20.50	118.00	0.50	1.20	1.00	2.20	22.60	16.20	14.00
700					-0.51	1212.00	14.80	0.00	17.60	1.00	74.00	21.00	106.00	0.50	1.00	0.50	2.80	7.00	14.30	31.00
800					-0.55	1361.00	14.40	0.00	18.60	0.70	75.00	20.00	104.00	0.50	1.00	0.00	2.40	26.60	16.10	15.00
900					-0.52	1617.00	14.20	0.00	16.60	1.00	73.00	19.50	105.00	0.50		-0.40	4.20	3.10	11.40	59.50
1000					-0.43	1847.00	14.10	0.00	15.00	5.00	73.00	19.50	121.00	0.50		-0.40	5.60	0.20	12.50	67.50
1100	0.00	-0.05	23.00	52.00	-0.46	2010.00	14.10	0.00	15.00	5.00	72.00	19.50	110.60	0.40		-0.50	6.00	0.10	9.50	110.00
1200	65.00	1.02	732.00	187.00	-0.35	1922.00	16.00	2.00	14.50	7.20	73.00	19.00	95.00	60.00		-0.60	7.00	-0.10	9.70	50.00
1300	65.00	1.03	822.05	265.00	-0.08	1942.00	15.70	2.60	14.50	7.20	72.00	19.00	87.00	45.50		-0.60	8.10	0.00	7.00	65.40
1400	65.00	1.01	896.00	310.00	-0.05	2000.00	15.60	3.00	14.50	7.20	71.00	19.00	83.00	56.00		-0.50	8.70	0.20	7.00	85.10
1500	65.00	1.02	920.00	330.00	-0.10	1970.00	16.20	2.30	14.40	7.20	70.00	19.00	71.00		38.70	-0.60	9.00	-0.10	7.10	86.20
1600	65.00	1.01	1021.00	356.00	-0.09	1982.00	15.60	3.90	14.50	7.30	69.00	19.00	70.00	55.70	35.00	-0.50	9.10	0.00	6.30	66.00
1700	65.00	1.01	1067.00	387.00	-0.05	2017.00	15.20	4.50	14.40	7.20	69.00	19.00	66.00	50.00	22.30	-0.70	9.70	0.10	5.70	62.70
1800	65.20	1.01	1100.02	401.00	-0.12	1987.00	15.20	4.70	14.40	7.30	68.00	19.00	62.00	37.00	19.30	-0.60	9.00	0.20	6.70	62.60
1900	65.00	1.00	1100.00	416.00	-0.11	1998.00	15.20	4.40	14.40	7.30	69.00	19.00	67.00		23.30	-0.50	9.10	3.20	6.00	63.20
2000	65.00	1.01	1098.00	428.00	-0.10	2002.00	15.10	4.70	14.40	7.20	69.00	19.00	72.00	42.00	23.00	-0.70	8.90	0.00	6.50	64.00
2100	65.00	0.99	1116.00	436.00	-0.04	2007.60	15.20	4.50	14.40	7.30	68.00	15.00	78.00		26.70	-0.60	9.00	0.00	7.00	61.50
2200	65.00	0.99	1100.00	443.00	-0.10	2011.00	15.20	4.60	14.60	7.20	68.00	19.00	78.00							
2300	65.00	0.99	1133.00	449.00	-0.03	2060.00	15.20	4.50	14.60	7.00	69.00	19.00	82.00		16.60	0.30	9.10	-0.10	6.70	56.20
2400	[illegible]	1.01	1131.00	454.00	-0.06	2007.00	15.00	4.70	14.40	7.30	69.00	19.00	76.00		18.00	0.30	8.90	0.10	6.00	58.30
2500	62.00	1.03	1106.00	435.00	-0.10	2064.00	15.60	4.00	14.40	7.40	70.00	19.00	86.00	34.00	19.00	0.30	8.80	0.00	7.00	58.00
2600	63.00	1.02	1136.00	450.00	-0.08	2006.00	15.10	3.70	14.00	7.00	70.00	19.25	88.00		13.50	0.60	8.80	0.30	6.90	58.60
2700	63.00	1.02	1126.00	465.00	-0.00	1992.00	16.40	4.30	15.00	7.00	70.00	19.00	86.00		16.20	0.40	8.60	0.10	7.10	60.60
2800														37.70	16.70	0.30	8.90	2.00	6.90	58.40
2900						2000.00								39.00	17.00	0.30	8.90	1.70	6.80	58.00
3000						2000.00								40.30	17.60	0.30	9.00	2.60	6.00	57.00
3100														46.30	17.50	0.40	9.00	2.60	6.00	56.30
3200						2000.00														
3300						2000.00														
3400																				
3500						2000.00														
3600																				
3700						2260.60														
[illegible]	63.97	1.06	1125.00	541.00	-0.65	1352.60	15.00	4.70	15.00	6.00	62.00	19.00	58.00	35.83	22.90	0.50	9.20	-0.40	6.60	59.10

DATA SHEET 4
PAGE 2 OF 7

Test Number	T-15		Run 1		
Temperature	600 Deg F	Heat-up Start	28		
Time	12 Hours	Steady State Start	44	Range #1 444..456	
Date of Test	22 Aug 89	Steady State Stop	56	Range #2 428..456	
		Test End	133	Range #3 423..4133	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HAC-301	FI-302	TIC-304	TI-324	PIC-221	TIC-321	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWC)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000						1990.00														
4100																				
4200																				
4300																				
4400						1500.00														
4500														0.50	1.50	0.50	5.00	2.60	11.20	87.30
4600	32.30	0.36	10.00	103.00	-0.12	1596.00	20.00	0.00	11.46	7.00	60.00	10.00	110.00	0.70	1.30	0.50	6.20	2.00	10.00	92.30
4700														0.10	1.40	0.50	7.20	1.90	9.40	104.40
4800														0.50	1.60	0.50	7.20	3.20	9.30	106.50
4900						1500.00								0.00	1.50	0.50	7.10	3.10	9.40	106.00
5000	32.30	0.36	20.00	110.00	-0.13	1515.00	20.00	0.00	15.00	6.60	62.00	10.00	114.00	0.70	1.50	0.50	7.10	3.30	9.50	104.60
5100														0.50	1.60	0.50	7.10	3.30	9.40	106.20
5200														0.70	1.20	0.50	7.10	3.00	9.40	106.70
5300														0.50	1.40	0.50	7.10	3.00	9.40	106.70
5400														0.70	1.20	0.00	7.10	2.00	9.40	106.30
5500						1500.00								0.60	1.00	0.40	7.10	2.60	9.30	107.40
5600														0.50	1.10	0.40	7.10	2.60	9.00	107.50
5700														0.55	1.10	0.40	7.10	2.60	9.40	105.70
5800														0.60	1.00	0.40	7.20	2.50	9.30	107.50
5900						1500.30								0.60	0.90	0.40	7.20	2.60	9.30	106.50
6000														0.50	1.00	0.40	7.20	2.60	9.30	107.40
6100														0.50	1.10	0.40	7.10	2.70	9.50	105.00
6200														0.50	0.90	0.40	7.10	2.50	9.40	104.50
6300														0.50	0.50	0.40	7.20	2.50	9.30	105.20
6400														0.40	1.00	0.00	7.10	2.40	9.40	103.70
6500														0.40	0.90	0.40	7.10	2.00	9.40	103.30
6600														0.50	0.90	0.40	7.10	2.50	9.40	102.30
6700														0.50	3.90	0.60	7.00	2.60	9.50	99.40
6800														6.90	8.00	3.60	6.20	3.10	10.20	87.40
6900														0.70	2.10	1.90	2.50	9.70	8.00	190.50
7000														0.50	1.30	0.60	6.30	3.00	10.70	98.90
7100														0.50	1.60	0.50	6.20	3.00	10.70	99.50
7200														0.60	1.30	0.50	6.30	3.10	10.70	99.40
7300														0.50	1.20	0.50	6.20	3.20	10.70	100.00
7400														0.40	1.40	0.50	6.20	3.20	10.70	100.20
7500														0.50	1.30	0.50	6.40	3.00	10.30	100.50
7600														0.40	1.30	0.50	6.90	3.00	9.60	105.50
7700														0.50	1.20	0.50	6.90	[illegible]	9.30	105.20
7800														0.50	1.10	0.50	7.00	2.90	9.50	103.60
7900														0.40	1.10	0.40	7.00	2.70	9.30	101.40

DATA SHEET 4
PAGE 3 OF 7

Test Number	T-15		Row #		
Temperature	600 Deg F	Heat-up Start	28		
Time	12 Hours	Steady State Start	44	Range #1 d44..d56	
Date of Test	22 Aug 88	Steady State Stop	56	Range #2 d28..d56	
		Test End	133	Range #3 d28..d133	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-301	FI-302	TIC-304	TI-324	PIC-331	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
8000														0.50	0.90	0.40	7.10	2.60	9.40	103.30
8100														0.40	1.00	0.40	7.00	2.60	9.50	102.50
8200														0.40	1.00	0.40	7.00	2.70	9.50	104.30
8300														0.30	1.00	0.40	7.00	2.60	9.50	103.30
8400														0.50	0.90	0.40	7.00	2.60	9.50	102.70
8530														0.30	0.90	0.40	7.00	2.60	9.50	104.40
8600														0.40	0.90	0.40	7.00	2.60	9.50	103.20
8700														0.30	0.90	0.40	7.00	2.60	9.60	102.30
8800														0.40	0.80	0.40	7.00	2.50	9.60	102.00
8900														0.30	0.90	0.40	7.00	2.50	9.60	102.60
9000														0.40	0.80	0.40	6.90	2.60	9.60	101.90
9100														4.70	0.30	3.66	5.90	6.60	9.50	106.60
9200														0.40	1.30	0.50	6.00	3.00	9.90	96.50
9320														0.50	1.40	0.50	6.00	3.10	9.90	94.40
9460														0.50	1.56	0.50	6.00	3.30	9.96	97.00
9530														0.60	1.50	0.50	6.00	3.30	9.96	98.60
9600														0.50	1.50	0.50	6.00	3.30	9.90	99.40
9700														0.70	1.40	0.50	6.70	3.30	9.90	100.30
9800														0.70	1.40	0.50	6.70	3.00	9.90	101.10
9900														0.50	1.50	0.50	6.70	3.30	9.90	102.30
10000														0.70	1.30	0.50	6.80	3.30	9.80	101.50
10100														0.60	1.30	0.50	6.80	3.10	9.70	101.30
10200														0.40	1.30	0.40	6.90	3.00	9.70	98.90
10300														0.50	1.10	0.40	6.50	2.80	9.60	97.00
10400														0.50	1.00	0.40	6.90	2.70	9.60	96.70
10500														0.40	1.10	0.40	6.93	2.70	9.60	96.00
10600														0.60	0.90	0.40	6.50	2.70	9.70	97.10
10700														0.40	1.00	0.40	6.90	2.60	9.70	99.40
10800														0.50	0.90	0.40	6.90	2.60	9.70	96.60
10900														0.40	1.00	0.40	6.90	2.70	9.70	95.60
11000														0.40	1.00	0.40	6.90	2.70	9.70	96.90
11100														0.60	1.00	0.40	6.90	2.70	9.70	97.30
11200														0.50	0.90	0.40	6.90	2.60	9.70	97.30
11300														0.30	0.90	0.40	6.90	2.50	9.80	96.10
11400														0.30	1.00	0.40	6.90	2.50	9.80	95.60
11500																				
11600																				

Test Number	T-15		Run 8		
Temperature	600 Deg F	Heat-up Start	28		
Time	11 Hours	Steady State Start	44	Range #1 #44..#56	
Date of Test	22 Aug 89	Steady State Stop	56	Range #2 #28..#56	
		Test End	133	Range #3 #28..#133	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Exit Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure
(names)	HIC-304	PI-302 (IWG)	TIC-304 (Deg F)	TI-324 (Deg F)	PIC-321 (IWG)	TIC-324 (Deg F)	PI-303 (PSIG)	PI-310 (PSIG)	PI-323 (PSIG)	PI-330 (PSIG)
Steady State Values Data Range #1										
Data Pts	2	2	2	2	2	8	2	2	2	2
Total	127.00	2.00	2265.00	1006.00	-0.16	15984.00	31.40	9.00	30.00	13.00
Mean	63.50	1.04	1132.50	503.00	-0.07	1998.00	15.70	4.56	15.00	6.50
Maximum	63.90	1.06	1136.00	541.00	-0.05	2000.00	16.40	4.70	15.00	7.00
Minimum	63.50	1.02	1129.02	465.00	-0.09	1992.00	15.00	4.30	15.00	6.06
Heat-up & Steady State Values Data Range #2										
Data Pts	18	18	18	18	18	24	18	18	18	18
Total	1160.00	17.18	17771.00	6820.00	-1.78	47849.00	276.60	67.10	263.00	126.20
Mean	61.10	0.96	987.28	378.90	-0.10	1993.71	15.37	3.73	14.61	7.02
Maximum	55.00	1.06	1136.00	541.00	-0.03	2017.00	16.40	4.70	15.00	7.00
Minimum	0.00	-0.05	20.00	52.00	-0.06	1922.00	14.10	0.00	14.46	5.00
Total Treatment Values Data Range #3										
Data Pts	20.30	20.00	20.00	25.00	20.00	31.00	20.00	20.00	20.00	20.00
Total	1165.10	17.96	17001.00	7152.00	-1.13	61750.62	317.40	67.10	252.40	140.00
Mean	58.25	0.88	850.05	357.60	-0.11	1991.94	15.87	3.35	14.62	7.00
Maximum	65.00	1.06	1136.00	541.00	-0.03	2017.00	20.00	4.70	15.00	7.00
Minimum	0.00	-0.03	10.00	52.00	-0.06	1922.00	14.10	0.00	14.40	5.00

Elapsed Time	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
(names)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
Steady State Values Data Range #1										
Data Pts	2	2	2	6	6	6	6	6	6	6
Total	132.00	38.00	144.00	199.10	150.10	2.20	53.60	10.60	41.00	350.00
Mean	66.00	19.00	72.00	33.02	18.02	0.37	8.93	1.77	6.83	58.33
Maximum	70.00	19.00	86.00	46.34	21.80	0.50	9.20	2.00	7.10	64.40
Minimum	62.00	19.00	58.00	35.00	16.20	0.30	8.60	-0.40	6.60	56.30
Heat-up & Steady State Values Data Range #2										
Data Pts	18	18	18	14	11	33	33	33	33	33
Total	1251.00	342.50	1415.00	565.34	261.10	-2.00	163.60	11.30	143.00	1364.00
Mean	69.50	19.03	78.61	40.38	21.36	-0.12	8.74	0.54	7.10	64.00
Maximum	73.00	19.50	110.00	56.00	23.00	0.50	9.70	2.00	9.30	110.00
Minimum	62.00	19.00	50.00	0.40	13.50	-0.70	6.00	-0.40	5.70	50.00
Total Treatment Values Data Range #3										
Data Pts	25.00	20.50	20.00	81.64	81.00	91.00	91.00	81.00	91.00	91.00
Total	1313.00	380.50	1620.00	611.30	453.20	-23.00	655.60	219.70	827.10	8538.20
Mean	64.66	19.03	81.95	7.27	5.20	0.36	7.25	2.41	9.09	93.04
Maximum	73.60	19.56	114.00	56.62	30.00	3.60	9.70	9.70	11.20	190.50
Minimum	60.60	19.00	50.00	0.30	0.20	-0.70	2.60	-0.40	6.70	50.00

12-Jan-90

DATA SHEET 4
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Test Number	T-15		Run #	
Temperature	600 Deg F	Heat-up Start	28	
Time	12 Hours	Steady State Start	43	Range #1 443..456
Date of Test	22-Aug-90	Steady State Stop	56	Range #2 428..456
		Test End	76	Range #3 428..476

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Roof	Exit Gas	Powder Box	Left Wall	Aluminum Pipe 1	Shell Support Bach 1 Surface	Shell Support Bach 2 Surface	Floor Bracket Right Side	Aluminum Pipe 2	Steam Heated Riser Internal	Clay Pipe Internal	Inlet Diffuser Bracket Surface	Clay Pipe Surface	Skip Hine External	Skip Hine Internal
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	104	106	115	100	105	104	107	96	100	94	101	93	95	101	98	103	104	88	96	105
100	103	102	113	106	103	103	106	98	100	97	101	97	98	100	98	102	103	95	98	103
200	102	101	113	106	103	102	106	99	100	99	101	99	99	101	99	102	102	98	100	103
300	103	101	112	106	103	102	105	100	103	100	101	100	100	101	100	102	102	99	101	102
400	102	110	112	103	103	102	105	100	99	101	101	101	101	101	100	102	102	100	102	103
500	103	100	111	105	102	102	104	101	100	101	101	101	101	101	101	102	102	101	102	103
600	102	100	111	104	103	102	105	101	98	102	102	101	102	101	101	102	102	102	103	104
700	103	101	112	104	103	103	105	102	100	102	102	102	103	101	101	102	102	103	103	104
800	102	100	111	103	102	102	104	105	99	102	102	102	102	100	101	102	101	103	103	104
900	101	98	111	103	102	101	104	101	98	102	101	102	102	98	101	101	101	103	103	103
1000	101	100	110	103	101	101	104	101	98	102	101	101	102	98	101	101	101	103	102	103
1100	230	134	115	127	225	200	225	140	225	106	116	100	119	105	100	210	240	103	106	140
1200	365	190	164	208	300	318	330	233	361	221	250	207	236	257	222	347	374	162	206	281
1300	435	245	219	270	461	383	392	298	436	294	336	307	312	351	288	419	450	246	296	363
1400	466	306	263	315	497	421	429	349	461	350	306	344	365	393	337	462	490	333	405	411
1500	501	320	290	356	532	453	455	381	481	368	415	382	403	417	367	478	518	477	427	443
1600	533	358	329	383	566	480	486	422	527	433	452	422	446	444	406	530	554	444	487	477
1700	570	407	361	422	602	504	514	462	537	473	484	459	480	465	443	547	583	463	500	511
1800	580	436	388	454	621	546	536	490	561	504	505	488	506	483	466	570	611	504	537	535
1900	600	455	405	460	638	556	546	500	585	523	521	506	524	486	481	590	617	525	550	544
2000	614	476	427	491	645	574	569	570	580	545	540	525	543	505	501	608	636	545	567	565
2100	634	488	441	504	644	581	563	548	582	553	549	536	551	536	512	608	642	563	571	575
2200	632	507	453	517	656	530	579	563	607	566	558	547	565	525	523	615	650	572	587	584
2300	645	516	466	534	660	600	584	563	618	580	560	557	575	534	534	634	658	580	602	595
2400	640	530	476	531	671	609	592	567	550	584	576	565	581	537	530	632	660	587	607	600
2500	660	523	480	541	666	600	593	568	594	586	574	566	582	540	539	643	667	600	606	599
2600	657	537	491	556	660	617	602	576	632	586	584	574	593	549	540	641	675	607	615	608
2700	660	555	500		630					630				555	555		660	630	650	630
2800	670	560	615		630					640				550	560		670	640	660	640
2900	670	569	615		630					640				560	560		670	640	660	640
3000	700	570	635		700					645				570	570		700	645	600	645
3100																				
3200	710	600	645		710					660				600	600		710	660	710	660
3300	720	620	660		720					665				620	620		720	665	720	665
3400																				
3500	725	630	600		725					700				630	630		725	700	725	700
3600																				
3700	735	650	600		735					730				650	650		735	790	735	790
3800	737	650	605	640	750	658	684	673	707	698	675	676	687	648	648	732	744	696	771	784

Test Number	T-15		Run #		
Temperature	606 Deg F	Heat-up Start	30		
Time	12 hours	Steady State Start	43	Range #1 443..456	
Date of Test	22-Aug-80	Steady State Stop	56	Range #2 428..456	
		Test End	76	Range #3 425..476	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Roof	Exit Gas	Powder Box	Left Wall	Aluminum Pipe 1	Shell Support Rack 1 Surface	Shell Support Rack 2 Surface	Floor Bracket Right Side	Aluminum Pipe 2	Steam Heated Riser Internal	Clay Pipe Internal	Inlet Diffuser Bracket Surface	Clay Pipe Surface	Ship Line Internal	Ship Line Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
4000	500	430			436		520		300	500		500		330	500	430		550	570	500	
4100																					
4200																					
4300																					
4400	320	350			276		360		315	330		330		315	330	370		330	310	310	
4500	313	351	315	307	270	311	350	312	354	331	317	330	311	344	336	371	302	332	315	321	
4600																					
4700																					
4800																					
4900	260	230	250				295	250	210	260	260	250	250	300	250	210	250	250	230	250	
5000																					
5100																					
5200																					
5300																					
5400	210	170	210	210		210	255	210	170	210	210	210	210	170	210	180	210	210	190	210	
5500																					
5600																					
5700																					
5800																					
5900	160	170	165	180		180	230	180	180	180	180	180	180	150	180	160	180	153	186	180	
6000																					
6100																					
6200																					
6300																					
6400																					
6500																					
6600																					
6700																					
6800																					
6900																					
7000																					
7100																					
7200																					

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Steady State Values
Data Range #1

Data Pts	10	10	10	2	10	2	2	1	2	10	1	1	2	10	10	5	10	10	10	10	6

12-Jun-90

DATA SHEET 4
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Test Number	T-16		Run 4		
Temperature	600 Deg F	Heat-up Start	28		
Time	12 Hours	Steady State Start	43	Range 11 443..456	
Date of Test	22-Aug-85	Steady State Stop	56	Range 12 428..456	
		Test End	76	Range 13 428..476	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Roof	Exit Gas	?er Box	Left Wall	Aluminum Pipe 1	Shell Support Rack 1 - Surface	Shell Support Rack 2 Surface	Floor Bracket Right Side	Aluminum Pipe 2	Steam Heated Riser Internal	Clay Pipe Internal	Inlet Diffuser Bracket Surface	Clay Pipe Surface	Ship Hine External	Ship Hine Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Total	6904	5332	5436	1206	7078	1315	1286	1253	1333	6134	1259	1250	1280	5943	5941	1373	7808	6743	6525	6752	0
Mean	690	533	543	603	708	658	643	627	678	673	630	625	640	594	594	687	784	674	653	675	532
Maximum	737	656	665	649	759	690	684	675	707	790	675	676	687	650	650	732	744	790	771	790	532
Minimum	667	527	491	556	663	617	602	578	632	586	584	574	593	540	548	641	660	687	615	606	532
Heat-up + Steady State Values																					
Data Range 12																					
Data Pts	26	25	25	17	25	17	17	17	17	25	17	17	17	25	25	17	25	25	25	25	0
Total	15665	11768	10712	7330	15542	8767	8672	7826	9115	13160	8057	7749	8067	12643	12208	9254	15379	13466	13998	13996	0
Mean	603	471	428	431	622	516	510	460	536	526	476	456	475	506	488	545	615	539	560	560	532
Maximum	737	659	665	649	759	696	684	675	707	790	675	676	687	650	650	732	744	790	771	790	532
Minimum	230	124	115	127	225	200	225	100	225	106	116	108	119	145	109	218	240	103	166	148	532
Total Treatment Values																					
Data Range 13																					
Data Pts	32	31	29	20	28	20	33	21	23	31	21	23	21	31	31	33	29	31	31	31	0
Total	16436	13281	11657	8007	16512	9468	19630	8736	10561	15231	9054	9530	9010	14046	13994	10797	16321	15306	15793	15761	0
Mean	526	428	402	400	530	473	465	418	458	491	431	415	428	453	451	468	563	494	509	508	532
Maximum	737	660	665	649	759	690	684	675	707	790	675	676	687	650	650	732	744	790	771	790	532
Minimum	0	124	115	127	225	180	225	100	170	106	116	108	119	150	109	160	180	103	166	148	532

TEST RUN 16
600°F/6 HOURS

DATA SHEET 1
PAGE 1 OF 1

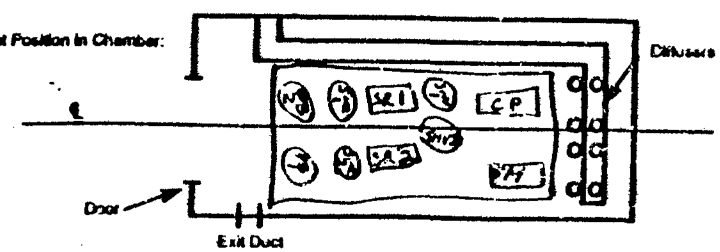
Test Run T-16
Test Duration 600°F/6hr.
Heat-Up Rate
Flash Chamber Temperature
Flash Chamber Interior

Date 24 AUG 89
Time

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt. (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. SSR 1	EXPLOSIVES	[illegible]	86.5	86.5							
2. SSR 2	↓	[illegible]	72.5	71							
3. PB 1		[illegible]	7.5	[illegible]							
4. PB 2		[illegible]	8.5	8.5							
5. SHR 1		[illegible] 9"	7.5	7.5							
6. SHR 2		[illegible] 9"	7.0	7.5							
7. CP		[illegible]	147.0	125							
8. SM		[illegible]	247.5	247.0							
9. SHV 1		[illegible] 15d	200.0	200.0							
10. SHV 2		[illegible] 15d	188.0	191.00							
11.											
12.											
13.											
14.											
15.											

177 867a

Equipment Position in Chamber:



* SHV 1 - [illegible]
* SHV 2 - [illegible] Missing

CP [illegible] 45

PRE TEST Notes:

* PB1 + PB2 tested with ethylenediamine; No color changes observed
* Color changed noted in bottom of SSR2, and SSR1. No color changes observed on the tops.
* Color change observed in [illegible] of SHR1
* C.P. - Piece [illegible] off of Flanged end.

SUMMARY
8/27/89

DATA SHEET 2
PAGE 1 OF 2

(1)

Date 8/27/89 Test Number T-16 600°F / 6 hrs

Time	Main Panel: Air Heater Inlet Diff. HIC-201	Air Heater Inlet Air Flow PI-202 (in WC)	Air Heater Temperature TE-204 (°F)	T.O. Inlet Air Temperature TI-204 (°F)	Bldg Pressure PIC 221 (in WC)	Bleed Air Valve Position HIC-22	T.O. Temperature TE-334 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-303 (PSIG)	Air Preheater: Burner Pressure PI-314 (in H2O)	Afterburner: Gas Pressure PI-325 (PSIG)	Afterburner: Burner Pressure PI-320 (PSIG)	Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (ppmv)	Flash Chamber Discharge THC (ppmv)	Afterburner Discharge THC (ppm)	CO2 (%)	CO (ppm)	O2 (%)	NOx (ppm)
0000																							
0100																							
0200																							
0300																							
0400																							
0500																							
0600																							
0700																							
0800																							
0900																							
1000																							
1100																							
1200	0.0	0.0	36	56	-.19	0.0	499	66/60	21.1	0	13.3	1.2		65	20	102	0.9		3.4	1.4	[illegible]	17.7	1.0
1300	0	0	36	56	-.19	0	564	57/60	21.1	0	13.3	0.2		66	20	102	0.9		3.4	1.6	20.1	17.0	0.2
1400	0	0	32	57	-.19	0	511	58/60	21.1	0	13.1	0.2		67	20	103	0.9		2.4	1.6	20.0	17.3	0.2
1500	0	0	34	54	-.19	0	574	58/61	21.1	0	13.5	0.4		68	20	103	0.9		2.2	1.6	20.4	17.3	0.9
1600	0	0	36	59	-.19	0	732	59/61	21.3	0	13.2	0.5		70	20	104	0.9		2.5	1.8	21.0	17.0	1.9
1700	0	0	36	59	-.18	0	417	70/62	21.1	0	13.1	0.7		70	20	109	0.9	1.4	3.3	2.1	21.4	17.0	12.2
1800	0	0	38	60	-.19	0	1104	70/62	21.0	0	13.3	0.3		71	20	111	0.9	1.4	0.9	2.3	22.4	16.1	13.5
1900	0	0	36	60	-.52	0	1217	71/62	20.4	0	14.0	1.1		71	20	112	1.0	1.4	0.1	2.4	14.7	15.1	11.6
2000	0	0	34	61	-.52	0	1511	74/63	20.3	0	14.0	1.4		72	20	115	1.0	1.4	0.1	1.4	4.5	15.4	13.9
2100	0	0	50	60	-.52	0	1466	74/62	19.5	0	11.0	1.6		76	19	117	1.0	1.4	0.3	[illegible]	2.4	[illegible]	[illegible]
2200	2	0	2.8	162	-.52	0	1512		0	0	14.2	5.5		70	20	118		1.4	0.2	6.6	0.2	0.6	[illegible]
2300	66	113	531	159	[illegible]	0	[illegible]		11.6	1.0	14.6	2.2		70	19	120	40.2		0.2	6.2	0.2	11.1	465

1045

1045 - START AFTERBURNER FOR T16.

* 2200 hrs - System oscillating more than usual on the afterburner [illegible]

2230 - Afterburner @ 200°F. Preheater started

* Insulation was placed around the chamber door causing the chamber negative

DATA SHEET 2
PAGE 2 OF 2

Date 8/28/89 (MON) Test Number T16 600°F/6 hr

Time	Main Panel: Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202 (INWC)	Air Heater Temperature TIC-304 (°F)	T.O. Inlet Air Temperature TI-324 (°F)	Stack Pressure PIC 221 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-324 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-322 (PSIG)	Burner Pressure PI-330 (PSIG)		Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Propane Tank: Air Heater Discharge THC (6N) (ppmv)	Flash Chamber Discharge THC (0.55) (ppmv)	Afterburner Discharge THC (ppm)	CO_2 (%)	CO (ppm)	O_2 (%)	NO_x (ppm)
0000	[illegible]	1.13	519	210	[illegible]	0	[illegible]		[illegible]	1.1		[illegible]	2.4			68	19	126	[illegible]	35.8	0.3	6.6	0.5	[illegible]	[illegible]
0100	[illegible]	1.13	519	227	[illegible]	0	1123		[illegible]	1.0		14.4	2.2			68	19	112	38.0		0.2	6.3	0.3	[illegible]	[illegible]
0200	[illegible]	1.12	[illegible]	[illegible]	[illegible]	0	[illegible]	29/54	[illegible]	1.9		[illegible]	2.4			66	19	91	42.0	41.5	0.2	7.0	0.0	[illegible]	[illegible]
0300	63.5	1.10	[illegible]	279	[illegible]	0	[illegible]		15.8	2.6		14.4	7.3			66	19	78	56.4		0.2	8.1	0.3	8.7	[illegible]
0400	63.5	1.11	914	336	[illegible]	0	1952		15.8	[illegible]		14.4	7.5			64	19	62	64.4		0.2	8.7	0.3	7.9	[illegible]
0500	63.5	1.14	[illegible]	381	[illegible]	0	1976	[illegible]	[illegible]	[illegible]		14.4	7.2			[illegible]	18.5	57	35.6	24.7	0.2	9.7	0.1	6.4	72
0600	63.5	1.11	1082	412	[illegible]	0	[illegible]		13.8	3.6		14.0	7.2			62	19	46	51.5		0.2	9.5	0.1	6.0	[illegible]
0700	63.5	1.09	1094	429	[illegible]	0	[illegible]		[illegible]	5.5		14.4	6.8			62	19	54		19.6	2.3	9.9	0.2	5.8	[illegible]
0800	63.5	1.06	1093	447	0.07	0	1995	17/53	14.9	5.0		14.4	6.7			62	19	63	35.7		0.5	9.6	0.1	6.0	60
0900	63.5	1.05	1071	452	[illegible]	0	[illegible]		14.9	4.9		14.5	6.7		502	63	19	70	32.6		0.4	9.5	0.4	6.3	55
1000	63.5	1.07	1035	458	0.07	0	2001	19/63	15.4	4.3		14.5	6.9			63	19	83		29.0	1.7	9.6	1.5	6.6	[illegible]
1100	63.5	1.06	1023	460	0.05	0	1996		15.5	4.5		[illegible]	[illegible]			65	19	87	33.4		1.3	9.3	1.0	6.3	[illegible]
1200																									
1300																									
1400																									
1500	12.6	0.30	242	[illegible]	[illegible]	0	[illegible]	13/66	15	0		[illegible]	[illegible]			70	18.5	[illegible]							
1600							[illegible]																		
1700							[illegible]																		
1800																									
1900							[illegible]																		
2000							2000																		
2100																									
2200							[illegible]																		
2300							[illegible]																		

NOTES: Preheater inlet vibrating very loudly when airpreheater temp. is increased.
- Propane leak found at preheater ignitor. (Sealed with duct tape).
1500 - T16 over, cool down begins.

7/89

TEST : T16

600°F / 6 hrs.

DATA SHEET 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
	← Di	ffus		or	→	[illegible]	Roof	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
0830																														
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1630																														
1730																														
1830																														
1930																														
2030																														
2130																														
2230																														
2330	212	138	166	194	303	281	290	252	221	240	149	269	203	264	211	280	115	244	289	253										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

J77 857c

8/28/89 MON. Test: 1 16 600 F / 16 hr.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB											I	E	I	E	I	I	E	E											
	← DIFFUSER →					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CP	[illegible]	CP	[illegible]										
0030	312	118	192	215	322	361	[illegible]	276	247	264	185	290	246	286	245	305	144	259	323	278										
0130	334	220	214	237	341	324	324	294	267	251	218	310	236	309	270	339	165	288	338	296										
0230	366	252	235	263	378	362	361	294	295	314	247	310	259	326	299	360	184	319	378	328										
0330	448	286	270	321	468	430	434	331	346	370	282	403	288	397	347	430	202	386	442	386										
0430	516	336	320	374	530	477	495	446	403	438	333	464	328	465	407	513	203	463	528	458										
0530	546	392	[illegible]	482	579	553	542	486	440	485	386	514	372	520	458	553	550	541	575	508										
0630	588	422	396	461	440	518	551	509	467	516	456	532	403	542	492	579	641	580	596	581										
0730	600	440	421	476	614	532	571	527	483	538	474	500	413	583	512	606	601	601	609	588										
0830	613	475	459	508	536	545	583	543	503	556	498	567	451	592	532	625	592	621	619	562										
0930	618	417	456	522	545	606	600	553	516	565	522	576	450	590	544	630	547	640	624	572										
1030	626	507	466	521	542	608	595	551	518	571	539	541	457	592	548	631	609	651	635	574										
1130	625	515	469	530	538	601	591	556	524	572	544	575	464	589	551	623	613	652	630	576										
1230 *																														
1330 *	POWER OUT TO MOLYTEK 4 CEM																													
1430	630	516	496	531	535	610	601	546	539	567	565	590	478	597	565	631	635	653	655	570										
1530	494	417	443	453	455	461	398	439	468	492	534	432	407	458	483	477	458	613	488	496										
1630	410	350	410		370	370	360		420	370	490		370	390	420		[illegible]	510	470	430										
1730	334	290	334	334	334	334	240	334	304	334	410	334	334	334	334	334	550	450	334	334										
1830																														
1930	295	255	295	295	295	295	250	295	340	295	310	295	295	245	295	245	440	530	295	295										
2030	265	220	265	265	265	265	230	265	310	265	310	265	220	265	265	265	380	335	265	265										
2130																														
2230	245	145	245	245	245	245	210	245	240	245	270	245	245	245	245	245	210	270	245	245										
2330	215	85	215	215	215	215	95	215	250	215	250	215	215	215	215	215	230	290	215	215										

Key:
Powder Boxes - PB
Shell Support Rack - SSR
Clay Pipe - CP
Ship Mine - SM
Steam Heated Riser - SHR
Steel Pipe - SP
Aluminum Pipe - AP
Motor with Gear Reducer - M
Steam Heated Discharge Valve - SDV

177 857c

* Lost power to the Molytec due to a bad V pump in the [illegible]

[illegible]

Test Number	T-16		Run 1		
Temperature	600 Deg F	Heat-up Start	21		
Time	6 Hours	Steady State Start	37	Range #1 437..443	
Date of Test	27-Aug-89	Steady State Stop	43	Range #2 437..443	
		Test End	83	Range #3 437..443	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	AIC-304	PI-302	TIC-304	TI 324	PdC-322	TIC-3[illegible]	PI 303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0					-0.13	490.00			14.60	0.20	65.60	20.00	102.00			2.00	1.40	19.40	17.70	9.00
100					-0.13	504.00			14.00	0.20	66.00	20.00	102.00			2.40	1.60	20.10	17.00	10.20
200					-0.13	511.00			14.00	0.20	67.00	20.00	103.00			2.40	1.60	20.00	17.20	10.70
300					-0.13	574.00			14.50	0.40	68.00	20.00	103.00			2.50	1.60	[illegible]	17.20	10.80
400					-0.13	722.00			14.20	0.50	70.00	20.00	104.00			2.50	1.80	[illegible]	17.00	11.00
500					-0.16	917.00			14.20	0.70	70.00	20.20	106.02		1.40	2.36	2.10	21.40	17.00	12.20
600					-0.18	1164.00			14.20	0.80	71.00	20.00	111.00		1.40	2.00	2.30	22.40	16.10	13.50
700					-0.52	1254.00			18.00	1.10	71.00	20.00	111.00		1.40	0.60	2.90	18.70	15.60	21.60
800					0.52	1511.00			18.00	1.40	72.00	20.00	112.00		1.40	0.40	4.00	4.50	13.40	43.90
900					-0.52	1645.00			17.00	1.60	70.00	19.00	112.00		1.40	0.30	6.50	7.60	14.00	20.00
1000	0.00	0.00	20.00	60.00	-0.52	1542.00	0.00	0.00	15.20	5.55	70.00	20.00	110.00		1.40	0.30	6.60	-0.20	10.60	86.00
1100	66.00	1.11	531.00	155.60	-0.04	1665.00	16.60	1.00	14.60	7.20	70.00	19.50	100.00	60.30		0.30	6.20	-0.20	11.20	46.60
1200	66.00	1.13	619.00	210.00	-0.06	1900.00	16.20	1.10	14.00	7.00	60.00	19.00	106.00	36.50	26.00	0.30	6.60	0.00	10.50	51.60
1300	66.00	1.13	519.00	227.00	-0.06	1923.00	16.60	1.00	14.00	7.20	64.00	18.00	102.00	30.60		0.20	6.70	-0.20	10.50	54.00
1400	66.00	1.12	560.00	246.00	-0.02	1954.00	16.20	1.40	14.40	7.00	66.00	19.00	91.00	43.00	41.50	0.20	7.00	0.00	10.20	55.30
1500	63.50	1.10	600.00	272.00	-0.04	1976.00	15.80	2.60	14.60	7.20	64.00	19.00	78.00	56.40		0.20	8.14	-0.20	8.70	57.60
1600	64.00	1.11	914.00	336.00	-0.16	1930.00	15.00	3.00	14.60	7.30	64.00	18.00	62.00	64.00		0.20	8.90	-0.20	7.00	60.40
1700	63.00	1.14	1060.00	381.00	-0.12	1976.00	15.00	3.40	14.00	7.30	63.00	18.50	52.00	35.60	34.70	0.20	4.30	-0.10	6.00	72.30
1800	63.50	1.11	1462.00	412.00	-0.04	2017.00	15.00	3.56	14.00	7.20	63.00	19.00	46.00	51.30		0.20	9.52	-0.10	6.00	60.00
1900	63.50	1.00	1604.00	428.00	-0.26	2040.00	14.00	5.50	14.00	6.80	62.00	19.00	54.00		19.60	0.30	5.90	-0.20	5.00	55.30
2000	63.50	1.06	1463.00	441.00	-0.04	1995.00	14.90	5.00	14.00	6.70	62.00	18.00	63.00	30.70		0.50	5.60	0.10	6.00	56.00
2100	63.50	1.06	1071.00	452.00	-0.04	1990.00	14.90	4.00	14.50	6.70	63.00	19.00	70.00	32.60		0.00	5.50	0.00	6.20	58.50
2200	63.50	1.07	1035.00	450.00	-0.07	2001.00	15.40	4.30	14.50	6.50	61.00	18.00	83.00		20.00	1.70	5.60	1.50	6.60	58.00
2300	63.50	1.06	1003.00	460.00	-0.06	1996.00	15.50	4.50	14.50	6.00	65.00	18.00	87.00	33.40		1.50	5.30	1.00	6.30	51.80
2400																				
2500																				
2600																				
2700	33.00	0.30	452.00	364.00	-0.14	1576.00	10.50	0.00	16.00	4.00	70.00	10.50	120.00							
2800						2600.00														
2900						2000.00														
3000																				
3100						2000.00														
3200						2000.00														
3300																				
3400						2000.00														
3500						2500.00														
3600																				
3700																				
3800																				

DATA SHEET 4
PAGE 2 OF 6

Test Number	T-16		Run 8	
Temperature	650 Deg F	Heat-up Start	27	
Time	6 Hours	Steady State Start	37	Range #1 437..443
Date of Test	27-Aug-89	Steady State Stop	42	Range #2 427..443
		Test End	88	Range #3 427..469

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-301	FI-302	TIC-304	TI-324	PIC-321	TIC-326	PI-303	PI-310	PI-323	PI-330										
(Hours)		(IWG)	(Deg F)	(Deg F)	(IWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000																				
4100																				
4200																				
4300																				
4400														1.00	1.30	0.10	6.70	3.50	10.10	11.20
4500														0.40	1.30	0.10	6.30	3.30	10.70	3.60
4600														0.30	1.30	0.10	6.35	3.30	10.60	0.30
4700														0.50	1.30	0.10	6.30	3.40	10.70	0.43
4800														0.40	1.40	0.10	6.30	3.50	10.00	0.50
4900														0.40	1.30	0.10	6.30	3.60	10.00	56.40
5000														0.70	1.30	0.10	6.20	4.10	10.00	0.20
5100														5.00	10.60	1.70	5.90	7.50	11.10	0.10
5200														1.50	3.70	0.10	6.20	3.60	10.90	56.00
5300														0.90	1.4[illegible]	0.10	6.20	3.60	10.00	105.60
5400														1.25	1.90	0.10	6.30	3.30	10.60	104.10
5500														0.50	16.40	0.10	6.30	3.10	10.00	105.10
5600														0.30	1.30	0.10	6.20	3.25	10.00	103.30
5700														0.50	1.30	0.10	6.30	3.00	10.00	101.00
5800														0.50	1.17	0.10	6.30	3.10	10.70	103.90
5900														0.50	0.95	0.10	6.30	3.20	10.00	103.30
6000														0.30	0.90	0.10	6.20	3.00	10.30	100.95
6100														0.40	1.00	0.10	6.20	2.90	10.00	101.00
6200														0.50	0.90	0.10	6.20	2.80	10.00	103.10
6300														0.30	0.30	0.10	6.20	2.80	10.00	103.00
6400														0.20	0.80	0.10	6.30	2.90	10.70	105.10
6500														0.43	0.75	0.10	6.30	2.90	10.70	104.80
6600														0.20	0.90	0.10	6.20	3.00	10.00	103.90
6700																				
6800																				
6900																				
7000																				
7100																				
7200																				

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Steady State Values
Data Range #4

Data Pts	4	4	4	4	4	4	4	4	4	4	4	4	4	3	1	4	4	4	4	4

Test Number	T-16		Run 8		
Temperature	600 Deg F	Heat-up Start	27		
Time	6 Hours	Steady State Start	37	Range #1 D37..D43	
Date of Test	27-Aug-89	Steady State Stop	43	Range #2 D27..D43	
		Test End	88	Range #3 D27..D88	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-201	PI-202	TIC-304	TI-224	PIC-221	TIC-335	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
Total	254.00	4.24	4192.00	1817.06	-0.20	7990.00	60.70	18.60	57.90	27.10	253.00	76.06	303.00	104.70	80.00	4.50	38.00	3.40	25.10	225.20
Mean	63.50	1.06	1048.00	454.25	-0.05	1997.50	15.18	4.65	14.48	6.78	63.25	19.00	75.75	34.90	20.00	1.13	9.50	0.85	6.28	56.30
Maximum	63.50	1.07	1063.00	460.00	-0.04	2001.00	15.50	5.00	14.50	6.90	65.00	19.00	87.00	36.70	20.00	1.70	9.60	1.50	6.60	58.00
Minimum	63.50	1.06	1003.00	447.00	-0.07	1935.00	14.90	4.30	14.40	6.70	62.00	19.00	63.00	32.60	20.00	0.50	9.30	0.10	6.00	51.90
Heat-up + Steady State Values																				
Data Range #2																				
Data Pts	14	14	14	14	14	14	14	14	14	14	14	14	14	11	6	14	14	14	14	14
Total	825.50	14.30	11187.00	4556.00	-1.28	27441.00	204.70	41.60	202.70	97.14	911.00	265.50	1111.00	470.00	151.00	6.60	111.60	1.70	118.90	825.10
Mean	58.96	1.02	798.79	325.43	-0.09	1960.07	14.62	2.97	14.48	6.94	65.07	18.96	79.36	42.73	25.17	0.47	7.97	0.12	8.49	58.94
Maximum	65.00	1.16	1004.00	460.00	-0.02	2017.00	16.60	5.50	15.20	7.00	75.00	20.00	110.00	64.00	41.50	1.70	9.90	1.50	11.20	66.06
Minimum	0.00	0.00	20.00	60.00	-0.52	1863.00	0.00	0.00	14.00	5.40	52.79	18.50	65.00	32.60	1.00	0.20	4.30	-0.30	5.00	45.00
Total Treatment Values																				
Data Range #3																				
Data Pts	15	15	15	15	15	21	15	15	15	15	15	15	15	34	29	39	39	37	37	37
Total	867.20	14.60	11489.00	4520.00	-1.43	41417.00	222.60	41.60	218.70	102.50	981.00	286.00	1231.00	487.06	203.00	12.30	254.90	80.28	360.50	2404.70
Mean	57.81	0.97	765.93	301.33	-0.10	1972.24	14.85	2.77	14.58	6.83	65.40	19.07	82.07	14.36	7.00	0.28	6.54	2.17	9.74	64.99
Maximum	66.60	1.14	1094.00	460.00	-0.02	2017.00	18.50	5.50	16.00	7.40	70.00	20.00	120.00	64.40	41.50	1.70	9.90	7.50	11.20	185.60
Minimum	0.60	0.06	20.00	60.00	-0.52	1065.00	0.00	0.06	14.00	4.00	62.00	18.50	65.00	0.20	0.70	0.10	4.30	-0.30	5.00	0.10

Test Number	T-16		Run 8
Temperature	600 Deg F	Heat-up Start	17
Time	6 Hours	Steady State Start	26	Range #1 426..432
Date of Test	24-Aug-88	Steady State Stop	32	Range #2 417..432
		Test End	80	Range #3 417..480

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Roof	Powder Box Surface	Steam Heated Riser Surface	Diffuser Bracket Left Wall	Middle Wall	Steam Heated Valve Internal	Steam Heated Valve Surface	Steam Heated Riser Internal	Steam Heated Riser External	Ship Hine Internal	Clay Pipe Internal	Ship Hine Surface	Clay Pipe External	Rear Inlet Bracket
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	252	178	166	134	303	281	290	253	221	240	149	269	303	259	211	300	116	214	299	253
100	312	198	192	215	322	307	310	276	217	264	185	290	216	286	245	305	144	259	323	278
200	334	220	214	237	341	326	326	294	257	301	218	310	236	309	276	330	165	300	338	296
246	365	252	236	263	378	352	361	324	295	314	247	340	259	336	293	360	184	319	378	327
300	448	286	270	321	468	430	434	391	346	379	302	403	288	387	347	430	202	376	442	386
460	516	336	320	379	530	497	495	446	403	438	333	464	328	465	407	513	303	463	520	458
600	564	382	364	422	579	553	512	466	440	485	386	514	372	520	458	552	550	541	575	530
700	540	422	396	461	600	562	551	529	467	516	436	532	403	542	492	579	641	580	596	531
800	600	440	421	476	614	552	571	527	483	538	470	550	413	563	512	606	601	601	609	548
900	613	473	430	504	636	595	583	513	503	556	490	567	431	568	532	625	582	621	618	562
1000	623	487	456	522	645	606	600	553	516	565	522	576	450	590	544	630	597	640	629	572
1100	636	507	466	531	642	600	595	554	518	571	539	581	457	552	540	631	609	651	635	579
1250	625	515	463	530	638	626	591	556	524	572	544	575	461	589	551	623	611	652	638	576
1300																				
1400																				
1550	636	516	496	530	635	610	601	566	530	587	545	590	479	597	568	632	638	683	636	590
1600	404	417	443	453	455	454	332	430	468	442	538	432	407	458	483	470	638	613	488	496
1700	410	350	410		370	370	359		420	396	490		396	390	420		620	546	420	430
1800	334	390	354	334	334	334	390	354	334	334	410	334	334	334	334	334	556	450	334	334
1900																				
2000	296	250	295	296	295	295	250	295	340	295	350	295	455	295	295	295	490	530	295	295
2100	365	320	365	365	365	365	330	365	310	365	310	365	365	365	365	365	380	335	365	365
2200																				
2300	246	196	245	245	245	245	210	245	290	245	370	245	245	245	245	245	310	270	245	245
2400	215	166	215	215	215	215	195	215	270	215	250	215	215	215	215	215	270	290	215	215
2500																				
2600																				
2700																				
2800																				
2900																				
3000																				
3100																				
3200																				
3300																				
3400																				
3500																				
3600																				
3700																				
3800																				
3863																				

DATA SHEET 4
PAGE 5 OF 6

Test Number T-16 | Run 1
Temperature 600 Deg F | Heat-up Start 17
Time 6 hours | Steady State Start 26 | Range #1 d25..d22
Date of Test 24-Aug-88 | Steady State Stop 32 | Range #2 d17..d19
Test End 80 | Range #3 d17..d23

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Roof	Powder Box Surface	Steam Heated Riser Surface	Diffuser Bracket Left Wall	Middle Wall	Steam Heated Valve Internal	Steam Heated Valve Surface	Steam Heated Riser Internal	Steam Heated Riser External	Ship Line Internal	Clay Pipe Internal	Ship Line Surface	Clay Pipe External	Rear Inlet Bracket
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
[illegible]																				
[illegible]																				
[illegible]																				
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Steady State Values
Data Range #1

Test Number F-16 Run 1
Temperature 600 Deg F Heat-up Start 17
Time 6 Hours Steady State Start 26 Range #1 426..432
Date of Test 26-Aug-88 Steady State Stop 32 Range #2 417..432
Test End 80 Range #3 417..440

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Roof	Powder Box Surface	Steam Heated Riser Surface	Diffuser Bracket Left Wall	Middle Wall	Steam Heated Valve Internal	Steam Heated Valve Surface	Steam Heated Riser Internal	Steam Heated Riser External	Ship Wine Internal	Clay Pipe Internal	Ship Wine Surface	Clay Pipe External	Rear Inlet Bracket	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Total	3122	2502	2522	2620	3106	3325	2970	2172	2500	2851	2660	2865	2290	2350	2743	3140	3046	3247	3147	2879	0
Mean	634	502	466	534	620	605	594	654	526	570	534	570	455	596	549	628	609	645	629	576	644
Maximum	630	546	496	530	645	610	661	566	530	587	565	590	478	597	560	631	635	683	635	590	822
Minimum	613	473	430	505	636	506	583	543	503	555	490	567	431	582	532	623	582	621	618	562	580
Heat-up + Steady State Values																					
Data Range #2																					
Data Pts	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	0
Total	8122	5332	4994	5575	7531	6821	6850	6215	5766	6257	5378	6561	4230	6637	5504	7096	6151	6886	7235	6464	0
Mean	610	374	360	398	521	494	489	448	412	450	384	469	357	474	427	507	439	492	517	462	628
Maximum	630	546	496	532	645	610	661	566	530	587	565	590	478	597	560	631	650	683	635	590	822
Minimum	258	172	166	184	303	281	290	253	221	260	160	260	203	268	211	200	115	214	299	253	800
Total Treatment Values																					
Data Range #3																					
Data Pts	21	21	21	20	21	21	21	20	21	21	21	20	21	21	21	20	21	21	21	21	0
Total	9380	7130	7111	7306	9510	9109	8173	8471	8261	8523	7997	8347	7149	8839	8241	8926	9405	9916	9457	8744	0
Mean	447	340	330	360	453	434	418	404	381	406	381	417	340	421	392	446	448	472	452	416	822
Maximum	630	546	496	530	645	610	661	566	530	587	565	590	478	597	560	631	650	683	635	590	822
Minimum	215	170	166	184	215	215	195	215	221	215	149	215	203	215	211	215	115	214	215	215	820

TEST RUN 17
600°F/48 HOURS

Test Run T-17

Test Duration 600°/48 hr AMM PICRATE

Heat Up Rate

Flash Chamber Temperature

Flash Chamber Interior

Date 8/29/83

Time

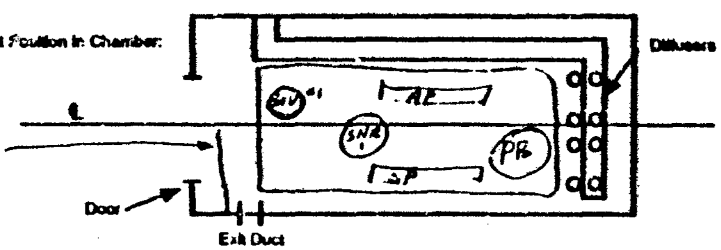
DATA SHEET 1
PAGE 1 OF 1

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt. (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. PB 1	AMM. PIC.	11½"	8.0	8.0						Oval Shaped No [illegible]	
2. PB 2		12½" × 15"	8.0	X						Good Condition [illegible]	No leak
3. PB 3		15½" × 8.9	10.0	X						Hole near handle [illegible]	[illegible]
4. AP 1		18" × 5 Φ	13.5	14.0						One L shaped [illegible]	
5. AP 2		18" × 5 [illegible]	13.5	X						Two L shaped [illegible]	
6. SP 1		[illegible]" × 21.6	20.5	20.5							
7. SP 2		72 × 21.6	20.5	X							
8. SHV 1			255.0	254.0							
9. SHV 2			238.0	X							
10. SHR 1		11¼ × 4.9	7.5	7.5							
11. SHR 2		11¼ × 4.9	7.5	X							
12.											
13.											
14.											
15.											

NOTE: ALL EQUIPMENT WAS PRE RINSED WITH ACN + HPLC WATER.

* All pipe supplied by HWAAP

Equipment Position In Chamber:



1/8 0530 opened flash chamber

Post Test Notes:

Paint flakes from rail car on floor, especially at door. Crack noted in floor ~ 1 meter in from door.

Inside of chamber walls and walls inside normal black appearance

(3)

DATA SHEET 2
PAGE 1 OF 1

Date 9/4/89 (Mon) Test Number T-17 600°F/48 hrs AMMON PICRATE

Time	Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow PI-202 (IN WC)	Air Heater Temperature TIC-304 (°F)	T.O. Inlet Air Temperature TI-324 (°F)	Bag Pressure PIC 221 (IN WC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-324 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater Gas Pressure PI-303 (PSIG)	Air Preheater Burner Pressure PI-310 (PSIG)		Afterburner Gas Pressure PI-323 (PSIG)	Afterburner Burner Pressure PI-330 (PSIG)		Propane Tank Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (ON) (ppmv)	Flash Chamber Discharge THC (off) (ppmv)	Afterburner Discharge THC	CO_2 (%)	CO	O_2 (%)	NO_x
0000																									
0100							[illegible]																		
0200																									
0300							2000																		
0400							2000																		
0500																									
0600	64.1	1.17	750	529	-0.08	0	[illegible]		15.0	3.4		13.8	2.2			52	18	122	86.5		0.2	8.5	0.4	8.2	[illegible]
0700	64.1	1.19	752	522	-0.08	0	[illegible]		15.4	2.9		13.8	2.2		3128	50	18	122	86.7		0	8.0	2.4	8.6	[illegible]
0800																									
0900	65.1	1.14	929	509	-.05	0	2011	10/60	15.1	3.5		14.1	2.2			59	15.5	130			[illegible]	11	[illegible]	7.3	[illegible]
1000	67.1	1.15	940	515	-.04	0	2000		15.2	3.6		14.2	1.1			60	15.5	129		~~55.9~~			0.4	7.5	[illegible]
1100	65.0	1.14	940	510	-.04	0	1999		15.4	3.7		14.2	1.0			60	15.5	128	65.0	55.9	0.2	11	0.2	7.1	[illegible]
1200	65.0	1.13	930	512	-.03	0	2004	80/60	15.5	3.0		14.1	2.0			61	15.5	124	63.3	48.5	0.2	11.7	0.3	7.6	5.4
1300																~~63~~	~~19~~	~~126~~							
1400	65.0	1.14	917	510	-.04	0	2003	58/67	16.7	3.0		14.1	2.1			63	19	126		45.8	0.2	11.7	0.1	7.8	[illegible]
1500	65.0	1.13	911	512	-.05	0	2005		15.1	3.0		14.5	2.2			66	19	137		[illegible]	0.2	10	0.5	7.8	[illegible]
1600																									
1700							[illegible]																		
1800							[illegible]																		
1900																									
2000							[illegible]																		
2100							[illegible]																		
2200																									
2300							[illegible]																		

- System being calibrated. Unable to gather CEM readings

0245 - Flame out on preheater, restarted at 0300 hrs.

0745 - Flame out on preheater, restarted at 0800 hrs.

2100 - Preheater shut down. T-17 Cooldown Begins.

- Concrete walls on outside of chamber are sweating water.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
	DI	FF	US	ORS	→	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	X	X	X	X	[illegible]										
0030	290	173	151	179	309	201	280	178	232	271	213	267	312	179	213					164										
0130	309	195	177	305	329	230	276	230	271	293	252	[illegible]	253	601	312					184										
0230	315	[illegible]	208	250	355	258	327	269	344	329	280	[illegible]	288	468	276					211										
0330	359	257	225	285	377	277	346	360	327	342	307	311	406	538	284					226										
0430	366	[illegible]	[illegible]	[illegible]	[illegible]	320	405	343	380	[illegible]	358	318	351	577	343					262										
0530	503	[illegible]	374	408	534	[illegible]	421	407	456	492	427	479	467	705	411					313										
0630	547	378	359	459	578	421	509	465	500	527	422	521	459	826	461					354										
0730	582	451	393	484	[illegible]	452	533	504	536	554	515	513	460	810	490					383										
0830	595	[illegible]	412	515	622	467	546	526	549	572	532	560	482	1013	511					407										
0930	610	[illegible]	435	530	534	490	561	515	570	510	552	579	479	1168	570					424			START							
1030	621	471	453	554	550	507	575	560	584	609	570	572	543	1125	546					454										
1130	635	505	470	566	605	520	564	523	578	616	593	604	545	1266	561					449										
1230	640	519	480	555	571	536	[illegible]	596	606	625	594	616	550	1335	572					485										
1330	650	525	501	591	579	546	600	595	615	635	605	624	563	1370	586					499										
1430	660	551	512	576	[illegible]	557	605	605	622	645	614	631	559	1414	593					513										
1530	661	[illegible]	521	593	696	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	637	563	1443	604					524										
1630	660	557	525	605	640	565	605	610	626	650	620	634	558	1456	600					526										
1730	[illegible]	561	531	[illegible]	691	571	579	615	630	651	623	638	570	1443	605					530										
1830	675	567	541	603	703	580	616	621	638	[illegible]	632	647	572	1392	615					541										
1930	672	574	546	608	700	588	619	626	645	[illegible]	638	653	571	1394	619					548										
2030	684	591	554	614	710	593	636	[illegible]	649	[illegible]	642	658	578	1252	625					556										
2130	691	600	563	626	715	[illegible]	639	638	657	642	650	665	595	1254	632					564										
2230																														
2330																														

177-357c

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

1 1 1 48 hrs @ 600°F (cont.)

9/3/89

DATA SHEET 3
PAGE 2 OF 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
	DIFFUSERS →					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Flame	[illegible]	AP INL	SP INL	PB [illegible]	X	X	X	X	[illegible]										
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
0830	671	636	614	649	652	626	638	640	677	671	690	671	605	1001	660					625										
0930	671	619	596	634	682	611	625	655	655	659	653	640	608	1155	641					614										
1030	671	611	584	627	658	609	626	656	647	660	657	654	605	1142	634					602										
1130																														
1230																														
1330																														
1430																														
1530																														
1630																														
1730	671	603	592	621	583	601	623	623	645	659	647	651	611	658	631					[illegible]										
1830																														
1930																														
2030																														
2130																														
2230																														
2330																														

Key:
Powder Boxes - PB
Shell Support Rack - SSR
Clay Pipe - CP
Ship Mine - SM
Steam Heated Riser - SHR
Steel Pipe - SP
Aluminum Pipe - AP
Motor with Gear Reducer - M
Steam Heated Discharge Valve - SDV

177 857c

Several flameouts occurred on preheater between 0900 & 0930 [illegible] 9/3/89

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
	DIFFUSERS →					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	X	X	X	X	[illegible]										
0030																														
0130	700				710		640	640		650		650		1000		640			710											
0230																														
0330	628	624	589	677	710	617	641	636	652	671	652	669	606	1110	641					610										
0430	617	631	599	647	712	621	659	646	659	677	609	674	613	1103	646					[illegible]										
0530	627	624	598	618	704	620	630	629	658	676	662	669	603	1010	647					624										
0630	644	631	605	650	705	624	643	649	664	673	660	674	612	1074	647					624										
0730																														
0830	648	581	589	655	648	589	607	665	677	636	614	654	590	1146	629					584										
0930	575	613	480	533	641	606	635	624	634	661	641	659	600	1230	630					606										
1030	591	621	555	542	595	610	633	631	647	625	630	663	605	1250	634					609										
1130	667	611	564	651	653	606	617	628	637	653	641	652	606	1271	629					604										
1230																														
1330																														
1430	672	614	586	652	587	606	620	630	641	657	642	652	616	1431	628					609										
1530	620	614	587	654	598	607	617	610	644	654	644	651	597	1478	612					603										
1630																														
1730	670				690					660	650	650		1000		600			665											
1830	680				650		.	640		660	650	650		1000		640			690											
1930																														
2030	680			650	610			640		660	650	650		1000		620			670											
2130	640			570	550	590	510	590	570	520	590	590		1000	550	460	460	.	560											
2230																														
2330	560			410	410		410	500		410	430	450		1000		350	350		560											

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 867c

Test Number	T-17		Run #		
Temperature	540 Deg F	Heat-up Start	30		
Time	35 Hours	Steady State Start	52	Image #1 d52..d100	
Date of Test	1 SEPT 88	Steady State Stop	100	Image #2 d30..d100	
		Test End	133	Image #3 d30..d133	

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	AHC-304	PI-302	TIC-304	TI-334	PIC 331	TIC-324	PI-363	PI-310	PI-323	PI-330										
(Hours)		(LBS)	(Deg F)	(Deg F)	(Inwc)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0														0.70	11.30	8.60	0.20	2.9	19.30	0.4
100														0.70	10.30	6.00	0.40	0.50	18.90	19.00
200														1.00	7.00	5.90	1.20	22.30	17.30	60.00
300														0.70	6.90	4.30	1.30	22.00	17.60	94.00
400														1.00	5.00	3.70	1.30	22.00	17.70	92.00
500														0.70	11.50	5.00	1.40	25.30	17.60	97.00
600														1.00	12.00	7.50	1.60	20.30	17.20	12.30
700														0.50	8.50	5.20	2.00	20.70	16.60	15.30
800														0.00	6.20	2.00	2.50	30.60	15.00	18.90
900														0.00	4.90	1.20	3.10	24.30	15.10	24.30
1000														0.50	3.00	0.20	3.26	14.00	14.90	30.20
1100														0.90	2.60	0.10	4.70	6.00	13.90	56.90
1200														6.60	2.30	0.10	5.70	3.50	11.50	79.00
1300														19.40	30.00	0.10	6.20	3.00	10.90	71.20
1400														30.70	51.70	0.10	6.32	2.30	10.96	60.10
1500														44.40	35.70	0.10	6.54	2.50	10.50	62.30
1600														54.70	55.70	0.10	6.00	3.00	10.10	53.00
1700														50.00	47.60	0.10	7.00	2.30	9.50	56.60
1800														71.20	57.60	0.10	8.60	2.00	7.90	54.60
1900														66.00	50.50	5.10	9.30	2.00	6.90	53.60
2000														45.00	30.30	0.18	9.00	2.50	6.10	54.60
2100														60.30	26.10	0.10	9.50	2.00	6.60	56.30
2200														33.20	21.40	0.10	9.00	3.10	6.20	57.90
2300														30.00	21.70	0.20	7.10	0.00	6.20	124.70
2400														30.40	19.30	2.00	8.00	3.00	6.00	93.40
2500														30.60	18.50	0.10	9.00	3.10	6.10	57.00
2600														28.70	17.00	0.10	9.90	3.20	6.10	58.60
2700														25.40	16.40	0.10	9.00	3.20	6.20	50.10
2800														25.60	16.40	0.10	9.50	3.25	6.50	50.00
2900														35.10	17.60	0.10	9.50	3.20	6.50	61.50
3000														36.30	19.10	0.50	9.50	3.20	6.50	66.70
3100														38.50	19.10	0.10	9.60	3.10	6.40	50.00
3200														45.50	19.70	0.10	9.30	3.20	6.00	58.30
3300														43.10	22.60	0.10	8.10	2.70	7.15	56.90
[illegible]														48.96	21.30	0.10	9.30	2.90	6.96	56.20
[illegible]														50.50	22.90	0.12	9.30	2.90	7.00	56.66
[illegible]														54.10	22.40	0.30	9.30	2.00	7.00	56.30
[illegible]														51.30	23.25	0.10	9.20	2.30	5.90	57.90
[illegible]														34.50	23.10	0.10	0.30	2.00	6.30	60.10
[illegible]														[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Test Number	T-11
Temperature	605 Deg F
Time	48 Hours
Date of Test	1 SEPT 88
Run	1
Heat-up Start	30
Steady State Start	52
Steady State Stop	108
Test End	133
Range #1	451..4168
Range #2	430..4106
Range #3	439..4133

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-304	FI-304	TIC-304	TI-324	PIC 321	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(SCFM)	(Deg F)	(Deg F)	(inWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000														53.70	22.20	0.10	9.40	2.60	6.86	55.20
4100														54.60	24.00	0.10	9.40	2.70	6.80	55.20
4200														53.00	25.20	0.10	9.40	2.90	6.80	56.70
4300														55.40	21.60	0.10	9.50	2.70	6.60	56.10
4400														55.30	24.10	0.10	9.60	2.60	6.60	57.00
4500														60.00	25.00	0.12	9.50	2.80	6.70	56.70
4600														49.90	20.50	4.10	6.90	7.40	7.30	123.00
4700														52.60	41.10	0.10	8.60	3.00	7.00	70.10
4800														54.10	43.30	0.10	9.30	2.90	7.16	63.40
4900														53.50	35.70	0.10	9.30	3.10	6.90	63.30
5000														52.40	38.50	0.10	9.10	3.10	7.30	63.60
5100														49.90	33.70	0.10	9.10	3.10	7.30	64.50
5200														48.20	34.00	0.10	9.00	3.20	7.30	65.10
5300														47.30	32.40	0.10	9.00	3.10	7.40	64.30
5400														45.00	31.60	0.10	9.00	3.10	7.40	64.60
5500														47.20	34.30	0.10	9.00	3.16	7.30	0.00
5600														54.50	44.10	0.10	9.10	2.90	7.30	62.50
5700														40.50	31.50	0.10	8.30	3.00	8.30	81.40
5800														69.20	48.50	0.10	9.10	2.70	7.20	60.30
5900														49.70	50.40	0.10	9.10	2.80	7.70	60.00
6000														55.10	39.40	0.10	8.60	2.80	8.20	76.30
6100														60.90	30.90	0.10	9.40	3.00	6.50	59.30
6200														63.00	40.30	0.10	9.40	3.00	6.90	60.50
6300														72.90	45.50	0.10	9.00	2.60	6.00	60.40
6400														54.70	25.90	0.10	8.50	2.80	8.20	81.30
6500														76.30	52.30	0.70	9.00	2.60	7.40	60.10
6600														82.40	61.50	0.10	8.70	2.70	7.90	62.00
6700														83.70	63.90	0.10	6.50	2.00	8.10	62.40
6800														85.30	65.90	0.10	8.00	2.50	8.40	63.10
6900														53.60	52.05	0.10	7.30	2.60	10.00	70.20
7000														77.30	56.00	0.10	9.10	3.20	7.40	62.00
7100														50.30	52.00	2.90	8.30	7.00	8.00	60.30
7200														63.60	53.10	0.20	8.90	3.30	7.60	64.50
7300														61.10	50.50	0.20	8.90	3.70	7.70	63.60
7400														56.70	47.60	0.20	8.80	3.30	7.70	65.60
7500														56.10	46.00	0.30	8.80	3.40	7.70	67.20
7600														54.10	43.50	0.20	[illegible]	8.50	7.70	62.90
7700														53.30	42.00	0.30	8.90	3.60	7.60	56.60
7800														52.50	41.00	0.20	8.95	3.50	7.60	66.60
7900														52.10	41.60	0.20	8.90	3.40	7.60	65.50

11-Jun-[illegible]

DATA SHEET 4
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Test Number	T 11		Run [illegible]	
Temperature	600 Deg F	Heat-up Start	30	
Time	48 Hours	Steady State Start	52	Image [illegible]
Date of Test	1 [illegible]	Steady State Stop	100	Image [illegible]
		Test End	[illegible]	Image [illegible]

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOx
	HIC-304	FI-302	TIC 304	TI-324	PIC 321	TIC-324	PI-303	PI-310	PI-325	PI-330										
(Hours)		(LBMS)	(Deg F)	(Deg F)	(INWC)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
[illegible]														34.50	43.40	0.30	8.90	9.20	7.50	64.70
[illegible]														67.00	50.10	0.10	3.00	3.90	7.60	62.00
[illegible]														71.10	37.20	0.10	8.30	3.90	8.10	73.00
[illegible]														1.70	3.90	0.10	5.00	3.00	11.00	103.40
[illegible]														0.90	1.90	0.20	5.60	2.70	12.00	101.90
[illegible]														0.30	1.00	0.10	5.60	3.00	12.60	96.40
[illegible]														0.06	1.00	0.20	5.60	2.90	12.00	96.90
[illegible]														0.20	1.70	0.30	5.60	2.90	12.30	92.20
[illegible]														0.00	1.60	0.20	5.30	3.60	12.40	84.50
[illegible]														0.70	1.60	0.20	5.15	3.50	12.60	93.06
[illegible]														0.76	1.40	0.20	5.00	3.00	12.00	74.50
[illegible]														0.60	1.50	0.20	4.90	3.60	13.00	80.60
[illegible]														0.60	1.00	0.10	4.70	2.70	13.20	64.50
[illegible]														0.30	1.30	0.20	4.60	2.90	13.30	62.00
[illegible]														6.76	1.60	0.20	5.70	3.20	11.00	81.70
[illegible]														4.30	7.20	1.00	6.76	4.30	9.00	109.50
[illegible]														1.10	2.70	5.70	6.10	7.10	10.50	130.60
[illegible]														0.20	2.00	0.30	7.50	3.00	9.50	122.60
[illegible]														1.00	1.00	0.30	7.00	3.00	9.60	123.70
[illegible]														0.90	1.90	0.30	7.00	3.60	9.60	122.30
[illegible]														0.30	2.00	0.30	7.00	3.60	9.60	124.30
[illegible]														1.00	2.10	0.30	7.00	3.70	9.60	125.70
[illegible]														1.20	1.80	0.30	7.30	3.60	9.60	125.00
[illegible]														1.10	1.60	0.30	7.40	3.60	9.60	124.90
[illegible]														0.00	1.90	0.30	7.00	3.70	9.60	125.90
[illegible]														0.90	1.50	0.20	7.30	3.00	9.60	119.30
[illegible]														0.70	1.00	3.10	7.00	3.70	9.30	120.40
[illegible]														0.00	1.30	0.10	7.30	3.90	9.60	120.90
[illegible]														0.60	1.40	0.10	7.30	3.90	9.60	119.50
[illegible]														0.60	1.30	0.16	7.30	3.00	9.60	117.20
[illegible]														0.70	1.20	0.10	7.30	3.90	9.60	114.10
[illegible]														6.63	1.5	0.10	7.20	3.00	9.70	121.00
[illegible]														1.40	1.3	0.20	6.90	3.90	9.86	113.60
[illegible]														4.50	1.1	0.1	6.30	2.70	10.06	111.66
[illegible]														3.50	6.5	0.1	6.30	2.66	16.15	105.10
11565														0.10	0.8	[illegible]	6.66	2.38	16.15	
[illegible]																				

Test Number	T-17			Run #	
Temperature	600 Deg F	Heat-up Start	36		
Time	48 Hours	Steady State Start	52	Range #1 d52..d100	
Date of Test	1 SEPT 90	Steady State Stop	100	Range #2 d36..d100	
		Test End	133	Range #3 d36..d133	

Elapsed Time (Hours)	Air Heater Inlet Damper Position AIC-301	Air Heater Inlet Air Flow FI-302 (ISSG)	Air Heater Temp TIC-304 (Deg F)	After Burner Inlet Temp TI-324 (Deg F)	Building Draft PIC-321 (IHWG)	After Burner Exit Temp TIC-326 (Deg F)	Air Heater Gas Pressure PI-303 (PSIG)	Air Heater Burner Pressure PI-310 (PSIG)	After Burner Gas Pressure PI-333 (PSIG)	After Burner Burner Pressure PI-330 (PSIG)	Propane Tank Temp (Deg F)	Propane Line Pressure (PSIG)	Propane Line Temp (Deg F)	Air Heater Exit THC (ppm/v)	Flash Chamber Exit THC (ppm/v)	After Burner Exit THC (ppm/v)	After Burner Exit CO2 (%)	After Burner Exit CO (ppm/v)	After Burner Exit O2 (%)	After Burner Exit NOx (ppm/v)
Steady State Values																				
Data Range #1																				
Data Pts	0	6	0	0	0	0	0	0	0	0	0	0	0	45	43	48	48	48	49	43
Total	0.00	0.00	0.00	0.00	0.90	0.00	0.66	0.90	0.30	0.00	0.00	0.00	0.02	2411.60	1196.00	12.70	436.00	151.20	361.20	3107.50
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51.98	38.11	0.26	6.06	5.09	7.51	65.05
Maximum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	85.36	65.00	4.10	9.60	7.00	11.00	123.00
Minimum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.30	2.90	0.10	6.00	0.50	6.60	0.00
Heat-up + Steady State Values																				
Data Range #2																				
Data Pts	0	0	0	0	0	0	0	0	0	0	0	0	0	75	75	71	75	71	71	71
Total	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3728.50	2524.00	26.40	625.64	221.01	533.10	4556.10
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	52.81	35.35	0.37	8.01	3.11	7.51	64.00
Maximum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	85.30	65.00	9.30	9.90	8.60	11.00	124.70
Minimum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.30	2.00	0.10	6.00	0.50	6.00	0.00
Total Treatment Values																				
Data Range #3																				
Data Pts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	165.00	160.00	102.00	105.00	106.00	105.00	104.00
Total	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.60	0.00	0.06	0.00	0.00	0.00	1151.40	2515.40	40.56	641.16	332.61	625.10	8641.60
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15.30	25.75	0.40	6.04	3.17	8.56	76.95
Maximum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	85.30	65.00	9.30	9.90	8.60	12.30	130.60
Minimum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10	1.30	2.10	6.04	0.50	6.00	6.00

DATA SHEET 4
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Test Number	Y-17		Run 0	
Temperature	600 Deg F	Heat-up Start	17	
Time	48 Hours	Steady State Start	30	Range #1 436..468
Date of Test	1-Sep-89	Steady State Stop	86	Range #2 417..446
		Test End	88	Range #3 417..468

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Steam Heated Valve External	Steam Heated Valve Internal	Roof	Inlet Diffuser Bracket	Middle Wall	Steam Heated Riser Internal	Aluminum Pipe	Steel Pipe	Pusher Bus		After Burner Exit Temp			Rear Diffuser Bracket
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	290	173	151	179	300	301	280	178	333	271	313	267	248	779	213					164
100	300	196	177	206	320	250	296	230	271	293	253	286	253	561	242		1800			184
200	348	223	300	256	365	258	327	260	304	328	230	323	258	463	276		1540			211
300	360	237	225	275	377	277	346	300	321	343	307	341	306	538	294					237
400	435	300	263	321	445	320	405	343	300	403	358	385	351	575	342		1350			282
500	503	348	316	400	534	300	441	400	450	483	437	479	407	905	411		1370			313
600	547	373	358	450	578	431	500	465	500	527	482	521	450	836	463					354
700	583	437	393	486	647	452	533	506	536	556	515	541	460	830	490		1900			383
800	586	632	412	515	622	467	546	538	549	573	532	560	482	1043	511					401
900	610	660	435	530	636	490	561	545	570	580	552	579	490	1160	530		2000			429
1000	624	671	453	554	650	507	575	560	584	606	570	582	543	1225	546		2030			450
1100	630	606	470	566	663	520	584	573	586	616	583	604	545	1260	561					468
1200	640	615	480	586	671	536	606	586	606	635	584	616	556	1136	578		1996			485
1300	650	635	501	591	679	546	600	596	615	526	606	636	563	1170	546		1500			490
1400	660	561	512	576	686	543	666	605	622	645	614	631	564	1414	583					512
1500	661	568	521	563	686	560	610	611	654	655	630	637	563	1407	600		1990			534
1600	660	557	526	606	690	565	666	610	626	650	630	634	556	1456	600		1900			530
1700	665	560	531	607	631	571	558	615	630	651	622	638	570	1413	606					530
1800	675	567	541	603	703	580	616	621	636	661	632	647	572	1232	615					541
1900	673	578	546	606	700	580	619	636	645	660	636	653	571	1314	519		1996			548
2000	686	601	554	616	710	553	628	632	649	675	642	658	570	1254	625					556
2100	681	650	563	626	715	600	634	630	657	642	650	663	566	1234	632		1996			564
2200																				
2300																	1990			
2400																	1530			
2500																				
2600																	1995			
2700																	1996			
2800																				
2900																	1996			
3000																	1535			
3100																				
3200	642	636	618	649	653	620	630	640	677	678	600	671	646	1106	660		1996			635
3300	671	644	586	636	582	617	625	655	655	654	653	660	605	1155	641		1995			614
3400	633	641	584	627	608	600	626	638	647	660	647	654	605	1142	634		1995			602
3500																				
3600																	1995			
3700																	1560			
3800																				

	Test Number	T-17		Run #																
	Temperature	600 Deg F	Heat-up Start	17																
	Time	48 Hours	Steady State Start	38		Range #1 638..663														
	Date of Test	1-Sep-88	Steady State Stop	86		Range #2 617..656														
			Test End	88		Range #3 617..658														
Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Steam Heated Valve External	Steam Heated Valve Internal	Roof	Inlet Diffuser Bracket	Middle Wall	Steam Heated Riser Internal	Aluminum Pipe	Steel Pipe	Powder Box		After Burner Exit Temp			Rear Diffuser Bracket
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
4000																				
4100	677	663	580	621	663	606	623	633	645	660	644	654	600	1150	633		1300			652
4200																	1500			
4300																				
4400																	1300			
4500																	1356			
4600																				
4700																	2000			
4800																	2000			
4900	700				725		640	640		650		650		1600		630			710	
5000																	2002			
5100	606	636	600	597	710	617	634	636	652	671	653	669	606	1110	643		2002			618
5200	607	631	599	647	712	621	639	646	650	677	650	673	613	1103	645					621
5300	607	636	590	640	794	620	636	643	656	672	662	662	603	1030	647		2003			624
5400	604	631	603	650	765	624	643	648	664	673	660	674	612	1071	647					625
5500																	2002			
5600	640	500	564	615	668	580	607	606	617	636	614	634	590	1146	600		1900			584
5700	675	613	582	633	691	606	625	624	634	651	641	653	600	1130	636					625
5800	681	622	585	642	690	610	630	631	647	665	650	663	606	1258	638		2002			600
5900	667	611	584	631	663	606	617	628	637	653	641	652	606	1271	628		2003			604
6000																				
6100																	2003			
6200	672	614	586	632	687	606	620	630	641	657	642	652	586	1131	628		2002			600
6300	670	614	587	634	688	607	617	630	644	656	644	651	587	1170	632					600
6400																	2002			
6500	670				680					660	650	650		1000		630	2002	645		
6600	680				680			640		660	650	650		1000		640		630		
6700																	1300			
6800	680			650	680			640		660	650	650		1000		620	1350	600		
6900	560			530	550	500	510	500	570	530	500	500		1000	560	460		560		
7000																	1300			
7100	560			410	450		410	500		410	430	450		1000		350		560		
7200																	1355			
7300																	1356			
7400																				
7500																	1360			
7600																	1330			
7700																				
7800																	1300			
7900																	1360			

Test Number	T-17
Temperature	600 Deg F
Time	48 Hours
Date of Test	1-May-[illegible]
Run #	
Heat-up Start	17
Steady State Start	38
Steady State Stop	86
Test End	88
Image #1	d[illegible]..d86
Image #2	d17..d[illegible]
Image #3	d17..d[illegible]

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Can	Steam Heated Valve External	Steam Heated Valve Internal	Roof	Inlet Diffuser Bracket	Middle Wall	Steam Heated Liner Internal	Aluminum Pipe	Steel Pipe	Feeder Box		After Burner Exit Temp			Rear Diffuser Bracket
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
8000																	1860			
8100																				
8200																	1825			
8300																	1990			
8400																				
8500																	1990			
8600																	1950			
8700																				
8800																	2000			
8900																	2000			
9000																				
9100																	1960			
9200																	1965			
9300																				
9400																	1980			
9500																	1900			
9600																				
9700																	1980			
9800																	1970			
9900																				
10000																	1970			
10100																				
10200																	1960			
10300																	1950			
10400																				
10500																	1940			
10600																	2000			
10700																				
10800																	2000			
10900																	2002			
11000																				
11100																	1995			
11200																	1990			
11300																				
11400																	2002			
11500																				
11600																	2005			
11700																	1985			
11800																				

Test Number	T-11		Box 6			
Temperature	600 Deg F	Heat-up Start	17			
Time	42 Hours	Steady State Start	38	Range #1 438..486		
Date of Test	1-Sep-89	Steady State Stop	58	Range #2 417..486		
		Test End	60	Range #3 417..488		

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Steam Heated Valve External	Steam Heated Valve Internal	Roof	Inlet Diffuser Bracket	Middle Wall	Steam Heated Riser Internal	Aluminum Pipe	Steel Pipe	Powder Box		After Burner Exit Temp			Rear Diffuser Bracket	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
12000																	1960				
12100																					
12200																	1850				
12300																	1835				
12400																					
12500																	1810				

Steady State Values
Data Range #1

Data Pts	20	15	15	17	20	16	17	19	16	20	19	20	15	20	16	6	32	4	1	15	0
Total	13410	9239	8014	10716	13106	9758	10564	12042	10304	13109	12279	13001	9021	23312	10031	3840	63871	2625	710	9696	0
Mean	671	616	534	630	655	610	621	636	644	655	646	650	601	1166	631	636	1996	656	710	646	888
Maximum	700	638	614	650	726	628	643	660	677	682	660	674	613	1170	660	640	2062	690	710	625	888
Minimum	560	585	563	530	550	589	610	590	573	539	590	590	585	1060	550	640	1900	560	710	564	888

Heat-up + Steady State Values
Data Range #2

Data Pts	41	36	36	38	41	37	38	40	37	41	40	41	36	41	37	6	44	4	1	36	0
Total	25256	18385	17390	20654	26018	19331	21473	22457	21256	24563	22546	24322	18815	45871	20384	3840	87562	2625	710	17673	0
Mean	616	511	483	549	635	524	565	562	575	599	576	593	526	1119	551	636	1990	656	710	491	888
Maximum	700	636	614	650	720	628	643	680	677	682	680	674	613	1197	660	640	2062	690	710	625	888
Minimum	290	173	151	172	309	201	223	178	232	271	313	267	342	463	313	460	1890	560	710	164	888

Total Treatment Values
Data Range #3

Data Pts	42	36	36	39	42	37	39	44	37	43	41	42	36	43	37	6	45	5	1	36	0
Total	25766	18385	17390	21264	26450	19381	21883	22547	21256	24573	23316	24772	18945	46671	20384	3330	85552	3185	710	17673	0
Mean	613	511	483	545	630	524	561	567	575	555	570	590	526	1116	551	555	1959	637	710	491	848
Maximum	700	636	614	650	720	628	643	665	677	663	680	674	613	1197	660	640	2062	690	710	625	848
Minimum	230	173	151	179	309	201	230	178	232	271	313	267	342	463	313	350	1890	560	710	164	888

TEST RUN 18
500°F/6 HOURS

DATA SHEET 1
PAGE 1 OF 1

Test Run T-1B
Test Duration 6 hrs
Heat-Up Rate
Flash Chamber Temperature 500°F

Date 9/13/89
Time

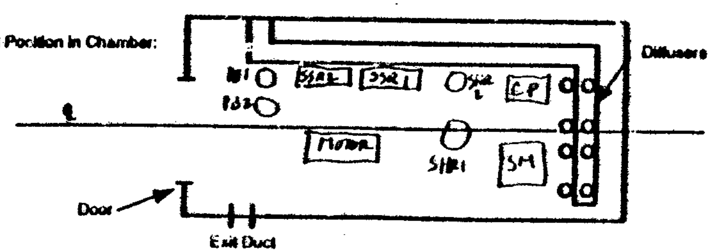
START UP 0825

Flash Chamber Interior

	Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt. (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spiked	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1	SSR 1		35¼" ø, [illegible]	72.5	72.5							
2	SSR 2		35¼ x 12½ x 2	85.5	85.5							
3	PB 1		31½" ø x 13	8.5	8.5							
4	PB2		13" ø x 13¼	8.0	8.0							
5	SHR 1		7" ø x 9"	11.5	11.5						Top Bowl	
6	SHR 2		4½" ø x 9"	5.5	7.0						Top nipple broken	
7	CP		36"	126.5	112.5						One handle missing	
8	SM			769.5	718.0							
9	MOTOR			940.5	841.5							
10												
11												
12												
13												
14												
15												

177 067a

Equipment Position in Chamber:



NOTES: Ethylene diamine applied to equipment, TNT also on following: SHR 1
SSR 1

SHIP MINE - End plate removed prior to test

MOTOR: Large oil stain on Gear Reducer.
Motor stand removed from base of Motor + Gear Reducer, but was still tested.

①

DATA SHEET 2
PAGE 1 OF 5

Date 9/13/89 Test Number T-18 500°/6 Hrs. #32

Time	Main Panel: Air Heater Inlet Damper HIC-301	Air Heater Inlet Air Flow PI-302 (INWC)	Air Heater Temperature TIC-304 (°F)	T.O. Inlet Air Temperature TI-324 (°F)	Bag. Pressure PIC 321 (INWC)	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-324 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-300 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Afterburner: Burner Pressure PI-320 (PSIG)		Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Air Heater Discharge THC (PPmv)	Flash Chamber Discharge THC (PPmv)	Afterburner Discharge THC	CO_2 (%)	CO	O_2 (%)	CH_4
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100	0	-0.02	14	59	-.033	0	482	72/59				111	0.3			62	17	68	CALIBRATION						
1200	0	-0.08	16	58	-.023	0	503					113	0.3			55	19	70	"	"					
1300	0	-0.07	20	58	-.025	0	577					111	0.6			58	19	71	"	"					
1400	0	-0.05	18	58	-0.24	0	702	64/63				112	0.6			60	19	102	2.0	2.0	1.8	1.8	[illegible]	[illegible]	12.3
1500	0	-0.05	17	57	-.026	0	911					119	0.8			62	19	108	CALIBRATING						
1600	0	-0.03	29	58	-.029	0	1091					119	1.8			64	19	105							
1700	0	-0.06	30	58	-.031	0	1123	55/62				126	1.9			66	19	115							
1800	0	-0.0[illegible]	31	59	0.23	0	1549	18/				120	2.3			66	19	122			1.4	2.6	8.5	18.4	2.7
1900	0	-0.05	26	58	-0.23	0	1650					121	1.4			65	18.5	132		1.4	2.3	0.7	1.2	19.1	1.6
2000	0	-0.06	25	57	-0.23	0	1826	78/58				16.0	'			64	18.5	130	38.6	0.7	0.2	0.2	1.1	18.5	7.3
2100	0	0.28	37	106	-.34	0	1738					14.8	76			62	18.0	.33	37.6	0.5	0.6	0.3	4.9	18.4	4.0
2200																			2.6	0.4		1.9	4.9	1.3	0.0
2300	16.4	1.15	547	136	-.01	0	1600		.55	1.7		.44	73			58	17.5	120	2.0	0.1		6.9	1.9	1.1	.12

* start (1800)
+4.9-CO (2100)

0826 START T.O. 0925 [illegible]

1230 [illegible] 1330 [illegible]

9/15 0020 - AFTERBURNER DOWN.
0800 - AFTERBURNER STARTED
0130 - PREHEATER STARTED

NOTE: Several attempts were made to ignite the preheater but without success @ 0200 hrs. Maybe [illegible] site. T.O. was left running + system on auto. [illegible] (9/

(2)

DATA SHEET 2
PAGE 2 OF 5

Date 9/14/89 Test Number T-18 500°F/6 hr.

Time	Main Panel: Air Heater Inlet Damper HIC-201	Main Panel: Air Heater Inlet Air Flow PI-202 (INWC)	Main Panel: Air Heater Temperature TIC-204 (°F)	Main Panel: T.O. Inlet Air Temperature TI-204 (°F)	Main Panel: Bag. Pressure PIC 221 (INWG)	Main Panel: Bleed Air Valve Position HIC-22	Main Panel: T.O. Temperature T-224 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-308 (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-323 (PSIG)	Afterburner: Burner Pressure PI-330 (PSIG)		Propane Tank: Capacity (Gal)	Propane Tank: Tank Temperature (°F)	Propane Tank: Line Pressure (PSIG)	Propane Tank: Line Temperature (°F)	Propane Tank: Air Heater Discharge THC ON (PPMV)	Propane Tank: Flash Chamber Discharge THC OFF (PPMV)	Afterburner Discharge: THC (ppmv)	Afterburner Discharge: CO_2 (%)	Afterburner Discharge: CO (ppmv)	Afterburner Discharge: O_2 (%)	Afterburner Discharge: NO_x (ppmv)
0000																									
0100																									
0200																									
0300																									
0400																									
0500																									
0600																									
0700																									
0800																									
0900																									
1000																									
1100	55	0.80	521	177	2.06	0	1818		16.4	1.0		14.2	7.5		1001	56	18.5	126		17.8	0.2	6.1	6.7	11.2	19.7
1200	55	0.84	50[illegible]	224	0.07	0	1855	80/60	16.5	1.0		14.4	7.6			57	19	127	21.7	~ 24.5	0.3	6.3	3.6	11.0	34.3
1300	57.4	0.67	561	255	0.03	0	1853		16.0	1.1		14.2	7.5			59	19	125	26	13.1	0.2	6.3	3.4	11.0	35.6
1400	60.0	0.89	853	283	0.01	0	1721		15.9	1.5		14.2	7.4			60	18.5	122	30.4	~~22~~	0.2	7.9	2.1	7.9	61.[illegible]
1500	60.0	0.87	971	327	0.04	0	1872	88/61	15.9	1.6		14.2	7.5			62	18.5	124	32	29.9	0.2	8.3	1.6	6.[illegible]	58.[illegible]
1600	60.0	0.88	1107	354	-.06	0	1923		15.4	3.[illegible]		14.4	7.6			63	18.5	120	32.5	31.5	0.2	9.5	3.6	7.2	61.[illegible]
1700	60.0	0.87	1091	373	-.05	0	1944		15.6	2.8		14.4	7.7			64	18.5	124	31.2	31.0	0.1	9.1	3.5	7.2	13.6
1800	60.0	0.89	1090	386	0.05	0	1944		15.4	3.2		14.2	7.6			64	19.0	124	28.4		0.1	9.5	3.7	6.9	63.5
1900	60.0	0.87	1087	397	0.04	0	1966	79/51	15.6	2.7		14.2	7.6			65	18.5	126	36.4	27 avg	0.1	9.7	3.5	6.6	63.[illegible]
2000																									
2100	61.0	0.86	1098	421	0.03	0	2020		16.0	2.5		14.0	7.5			64	18.5	124	21.5		0.1	10.0	4.3	5.8	44.[illegible]
2200	55.1	0.74	919	402	0.07	0	1999		15.3	2.6		14.4	7.7			63	19	122		26.0	0	9.0	2.8	12	12.[illegible]
2300																									

- PRE heater STARTED @ 1015 hrs this date.
- Received 8000 gallons of PROPANE this date @ ≈ 0700 hrs.
- 2000 hrs (9/14/89) STEADY STATE CONDITION 500°F. reached.

(3)

DATA SHEET 2
PAGE 3 OF 5

Date 9/5/82 Test Number T-18 500°F/6 hr.

Time	Main Panel: Air Heater Inlet Damper HIC-301	Air Heater Inlet Air Flow PI-?? (INWC)	Air Heater Temperature TIC-304 (°F)	T.O. Inlet Air Temperature TI-224 (°F)	Bag. Pressure PIC 271 (INWC)	Bleed Air Valve Position HIC 12	T.O. Temperature TIC-324 (°F)	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-30? (PSIG)	Air Preheater: Burner Pressure PI-310 (PSIG)		Afterburner: Gas Pressure PI-322 (PSIG)	Afterburner: Burner Pressure PI-320 (PSIG)		Propane Tank: Quantity (Gal)	Tank Temperature (°F)	Line Pressure (PSIG)	Line Temperature (°F)	Propane Tank: Air Heater Discharge THC (PPmv)	Flash Chamber Discharge THC (PPmv)	Afterburner Discharge: HC	CO_2 (%)	CO	O_2 (%)	NO_x
0000			152				[illegible]																		
0100																									
0200	55.1	0.75	921	446	.005	0	[illegible]																		
0300																									
0400																									
0500			[illegible]				[illegible]																		
0600																									
0700																									
0800	[illegible]	0.47	[illegible]	133	-.15	0	[illegible]	62/09				14.4	7.7			12	11	128	0.8	2.5	0.0	4.9	4.1	13.8	2.1
0900	[illegible]	[illegible]	12	121	-.11	0	[illegible]					12.5	7.6			12	11	128							
1000			[illegible]																						
1100																									
1200																									
1300																									
1400			[illegible]																						
1500	34.9	0.46	31	103	-.11	0	185	80/62				15.0	7.5			65	11.5	127	0.6	1.4	0.2	2.0	1.2	7.0	11.2
1600																									
1700																									
1800																									
1900																									
2000																									
2100																									
2200																									
2300																									

T-18 Complete @ 0200 hrs. Cooldown begins

DATA SHEET 2
PAGE 4 OF 5

(4)

Date 9/16/89 Test Number TII 500°/6 HRS

Time	Main Panel: Air Heater Inlet Damper HIC-201	Main Panel: Air Heater Inlet Air Flow FI-202	Main Panel: Air Heater Temperature TIC-304	Main Panel: T.O. Inlet Air Temperature TI-334	Main Panel: Bag. Pressure PIC 221	Main Panel: Exhaust Air Valve Position HIC-22	Main Panel: T.O. Temperature TIC-334	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Moisture Content	Air Preheater: Gas Pressure PI-304	Air Preheater: Burner Pressure PI-310		Afterburner: Gas Pressure PI-323	Afterburner: Burner Pressure PI-3[illegible]		Propane Tank: Gallons	Propane Tank: Tank Temperature	Propane Tank: Line Pressure	Propane Tank: Line Temperature	Air Heater Discharge THC	Flash Chamber Discharge THC	Afterburner Discharge THC	Afterburner Discharge CO_2	Afterburner Discharge CO	Afterburner Discharge O_2	Afterburner Discharge NO_x
		INWC	°F	°F	IN/G		°F		PSIG	PSIG		PSIG	PSIG		Gal	°F	PSIG	°F	PPMV	PPMV	ppm	%	ppm	%	ppm
0000							[illegible]																		
0100																									
0200							1560																		
0300																									
0400																									
0500							[illegible]																		
0600																									
0700																									
0800 5	35.0	.36	9	59	2.0	0	1599	67/51				54.5	7.6			59	19	124	Calibrating						
0900	35.0	0.35	14	60	0.12	0	1562									57	19	138	0.9	1.0	—	0.2	6.9	5.1	15	11.2
1000																									
1100							[illegible]																		
1200																									
1300							[illegible]																		
1400																									
1500																									
1600																									
1700																									
1800							[illegible]																		
1900																									
2000																									
2100																									
2200																									
2300							[illegible]																		

[illegible] run 1 →

← CEM arrived 0912

177 0570

DATA SHEET 2
PAGE 5 OF 5

Date 9/17/89 Test Number T15 500°/6 HRS

Time	Main Panel								Air Preheater			Afterburner			Propane Tank				Propane Tank						
	Air Heater Inlet Damper HIC-201	Air Heater Inlet Air Flow FI-202	Air Heater Temperature TIC-204	T.O. Inlet Air Temperature TI-224	Bag. Pressure PIC 221	Bleed Air Valve Position HIC-22	T.O. Temperature TIC-324	Ambient Conditions: Dry Bulb Temperature, Wet Bulb Temperature and Mercury Column	Gas Pressure PI-303	Burner Pressure PI-310		Gas Pressure PI-32?	Burner Pressure PI-330		Capacity	Tank Temperature	Line Pressure	Line Temperature	Air Heater Discharge THC	Flash Chamber Discharge THC	Afterburner Discharge THC	CO_2	CO	O_2	H_2O
		INWC	°F	°F	INWG		°F		PSIG	PSIG		PSIG	PSIG		Gal	°F	PSIG	°F	PPmv	PPmv	ppm	%	ppm	%	ppm
0000																									
0100																									
0200																									
0300																									
0400																									
0500							1347																		
0600	16.0	3.5	3	90	-.86	0	109																		
0700																									
0800																									
0900																									
1000																									
1100																									
1200																									
1300																									
1400																									
1500																									
1600																									
1700																									
1800																									
1900																									
2000																									
2100																									
2200																									
2300																									

0530 CALL FROM SECURITY : SYSTEM TRIP DUE TO ELECTRICAL STORMS
0530 CITY & AIR ONSITE. EQUIPMENT IS COOL AND LIGHTNING DISCHARGES ARE STILL PRESENT IN AREA SO T.O. WILL BE LEFT SHUT DOWN.

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	PB																													
						[illegible]	[illegible]		[illegible]	PB1	[illegible] INT.	[illegible]		SSR 1		[illegible]	CP INT	[illegible]	SM INT	[illegible] INT										
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
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1630																														
1730																														
1830																														
1930																														
2030																														
2130																														
2230																														
2330																														

JG

0825 START T-0.

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177 857c

No TEMP'S Recorded DIFFICULTY [illegible] PREHEATED

9/14/89 T18 500°/6 HRS. AIR HEATER STARTED 1015

(2)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
						[illegible]	[illegible]	[illegible]		PBI	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
0030																														
0130																														
0230																														
0330																														
0430																														
0530																														
0630																														
0730																														
0830																														
0930																														
1030																														
1130	313	183	200	176	217	243	318			272	227		178		266	313	170	253	231	243										
1230	326	184	204	176	224	225	331			295	248		189		254	323	165	307	259	266										
1330	[illegible]	[illegible]	[illegible]			345	377			323	247		210		312	361	228	348	282	290										
1430	449	248	290	230	304	287	457			407	332		250		311	451	293	427	353	452										
1530	486	265	326	255	339	366	469			441	362		286		428	467	430	473	403	481										
1630	539	361	406	305	401	354	521			478	392		352		481	541	497	507	473	483										
1730	566	381	422	324	423	358	527			506	404		373		493	555	470	519	485	498										
1830	569	405	449	346	446	374	537			532	422		370		511	574	505	537	509	518										
1930	564	427	458	363	452	386	541	548		531	428		440		524	567	558	534	529	533										
2030																														
2130								412					416																	
2230																														
~~0000~~ 0200 9/15/89	545	449	471	378	464	518	514	514		548	459		470		519	565	528	511	520	524										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177-857c

1/15/07

(3)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
0030	555		460	450	460	390	555	510	925	515	435	860	460	865	510	555	525	510	515	515										
0130																														
0230																														
0330																														
C430																														
0530	265	200	250	225	220	335	210	230	756	335	210	690		845	250	[illegible]	[illegible]	260	290	[illegible]										
0630																														
0730																														
0830	212	166	207	171	171	184	181	179		201	220		278		207	216	221	198	219	219										
0930	205	162	188	170	167	168	180	176		197	219		262		204	211	207	192	210	208										
1030	190	160	200	165	165	190	185	170	230	185	205	660			190	205	190	190		195										
1130																														
1230																														
1330																														
1430	177	145	135	154	152	163	158	156		170	189		208		171	178	172	166	174	176										
1530																														
1630																														
1730																														
1830																														
1930	155	155	155	155	155	155	155	155			265	[illegible]	275		155	155	155	155	155											
2030																														
2130																														
2230																														
2330	125	125	125	125	125	125	125	125		125	150		150		125	125	125	125	[illegible]	125										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177-857c

9/16/89 T18 500°/6 HRS

DATA SHEET 3
PAGE 4 OF 5

(4)

Time	Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		PB																													
0030		125	120	120	120	120	120	120	110		120	140		140		120	120	120	120	120	120										
0130																															
0230																															
0330																															
0430																															
0530		115	115	115	115	115	115	115	115		115	135		135		115	115	115	115	115	115										
0630																															
0730	Start																														
0830	Heat	126	115	125	109	107	113	112	111		111	131		131		112	122	114	113	118	118										
0930																															
1030																															
1130																															
1230																															
1330		110	110	110	110	110	110	110	110		112	135		135		110	110	110	110	110	110										
1430																															
1530																															
1630																															
1730																															
1830		110	110	110	110	110	110	110	110		110	130		130		110	110	110	110	110	110										
1930																															
2030																															
2130																															
2230																															
2330		105	105	105	105	105	105	105	105		105	105		105		105	105	105	105	105	105										

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

140°/6

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Equip.	PB																													
0030		100	100	100	100	100	100	100	100		100	120		120		100	100	100	100	100	100										
0130																															
0230																															
0330																															
0430																															
0530																															
0630	9/17/89	98	57	80	98	93	105	101	98	0	95	76		77		102	98	98	103	101	102										
0730																															
0830	9/18/89	74	56	104	72	92	86	95	63		80	65		67		96	88	99	72	78	106										
0930																															
1030																															
1130																															
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1830																															
1930																															
2030																															
2130																															
2230																															
2330																															

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Ship Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

177-857c

DATA SHEET 4
PAGE 1 OF 6

Test Number	T-18	Run #	
Temperature	500 Deg F	Heat-up Start	11
Time	6 Hours	Steady State Start	25	Range #1 415..431
Date of Test	13-Sept.-88	Steady State Stop	31	Range #2 417..431
		Test End	82	Range #3 417..482

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit NO2	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-201	PI-202	TIC-204	TI-224	PIC-221	TIC-326	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
0	55.00	0.06	521.00	177.00	-0.03	1818.00	16.40	1.00	14.36	7.50	56.00	10.50	126.00		17.00	0.20	6.10	6.30	11.20	43.70
100	55.00	0.00	555.00	223.00	-0.07	1845.00	16.50	1.00	14.40	7.50	57.00	10.60	127.00	31.70	16.50	0.20	6.30	3.60	11.00	44.30
200	50.30	0.67	461.00	225.60	-0.08	1854.90	16.00	1.10	14.20	7.50	58.00	10.00	125.00	30.00	13.10	0.20	6.30	3.60	11.00	53.60
300	50.50	0.80	853.00	283.00	-0.01	1901.60	15.40	2.50	14.20	7.40	30.00	10.50	122.00	30.40		0.30	7.90	7.60	8.90	61.30
400	60.00	0.87	971.00	327.00	-0.34	1847.00	15.40	2.60	14.20	7.50	62.00	10.50	124.00	32.00	30.90	0.30	8.30	3.60	8.40	87.30
500	63.00	0.80	1107.00	354.00	-0.06	1920.00	15.40	3.20	14.00	7.60	63.00	10.50	130.00	32.50	31.50	0.20	9.30	3.60	7.20	64.00
600	80.00	0.87	1081.06	373.00	-0.05	1942.00	15.60	3.00	14.40	7.70	64.00	10.50	124.00	31.30	31.00	0.10	9.10	3.50	7.20	63.60
700	60.66	0.00	1058.00	386.00	-0.05	1961.06	15.40	3.25	14.20	7.60	64.65	10.00	124.00	30.60		0.10	9.50	3.70	6.90	63.59
800	60.65	0.87	1067.00	397.00	-0.04	1986.00	15.00	3.70	14.20	7.60	62.00	10.50	125.00	36.60	37.00	0.10	9.70	3.50	6.60	63.40
900																				
1000	80.60	0.06	1000.00	421.00	-0.03	2020.00	16.00	2.50	14.00	7.56	64.33	10.50	124.00	30.50		0.10	10.00	4.30	5.00	64.30
1100	66.10	0.74	919.00	402.00	-0.07	1999.00	15.30	2.60	14.40	7.90	63.00	10.00	112.00		36.00	0.00	9.90	3.00	7.30	71.70
1200																				
1300			960.00											32.90	34.00	0.10	0.10	6.50	7.00	96.00
1400	56.20	9.75	921.00	606.30	-0.06	2002.00								1.30	4.06	0.10	8.90	6.30	11.70	116.00
1500														1.10	3.10	0.10	8.50	6.20	12.10	93.10
1600														0.90	3.00	0.10	6.20	8.10	12.40	81.00
1700			0.00											0.90	4.60	0.10	6.20	6.20	12.54	75.90
1800														1.00	5.20	0.10	6.10	6.20	12.60	72.10
1900														0.90	6.30	0.10	5.10	8.70	12.70	60.00
2000	26.50	0.43	0.00	133.00	-0.16	1791.00			14.60	7.70	50.00	10.00	120.00	0.60	9.20	2.00	4.50	11.50	11.70	100.00
2100	26.00	0.38	12.06	121.00	-6.11	1827.00			14.50	7.60	50.00	10.60	133.00	0.90	1.70	0.30	6.70	5.50	11.50	121.40
2200			30.00											1.00	1.70	0.20	7.60	6.00	9.10	112.00
2300														0.80	1.90	0.20	7.20	6.00	9.00	115.50
2400														0.90	1.00	0.20	7.30	6.10	9.00	115.90
2500														2.90	1.50	0.20	7.20	6.00	9.00	115.20
2600			20.00											0.96	1.70	0.20	7.20	6.00	9.90	112.20
2700	34.90	0.40	31.00	103.00	-0.11	1926.00			16.00	7.90	65.00	15.50	127.00	0.90	1.60	0.20	7.10	6.00	9.90	111.90
2800														0.70	1.30	0.20	7.10	6.60	9.90	163.00
2900														3.70	1.70	0.20	7.10	6.00	9.90	111.40
3000														0.00	1.47	0.10	7.20	5.8	9.40	100.00
3100			30.06											0.70	1.40	0.10	7.20	6.00	9.00	106.70
3200						1900.00								0.60	1.40	0.10	7.20	6.00	9.00	106.00
3300														0.70	1.10	0.10	7.10	6.90	9.90	108.10
3400														6.60	1.20	0.10	7.10	5.40	10.00	106.20
3500			5.20											0.60	1.20	0.10	7.00	5.30	10.00	104.50
3600														0.60	1.20	0.10	7.00	5.30	10.10	103.40
3700														0.56	1.20	0.10	7.00	5.30	10.10	102.20
3800						1966.00								0.70	1.00	0.16	7.00	5.10	10.10	98.50
[illegible]														[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Test Number	T-18		Run #	
Temperature	500 Deg F	Heat-up Start	17	
Time	6 Hours	Steady State Start	25	Range #1 #25..#31
Date of Test	13-Sept.-88	Steady State Stop	31	Range #2 #17..#31
		Test End	82	Range #3 #17..#82

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit TAC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOX
	HIC-201	PI-202	TIC-304	TI-224	PIC-221	TIC-326	PI-303	PI-310	PI-323	PI-330										
(Hours)		(INWG)	(Deg F)	(Deg F)	(INWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
4000														0.60	1.00	0.10	6.90	5.30	10.20	97.40
4100														0.50	0.90	0.10	6.90	5.30	10.20	96.00
4200														0.50	1.00	0.10	6.90	5.00	10.23	95.00
4350														0.50	1.00	0.10	6.80	5.20	10.30	93.00
4467						1848.00								28.10	16.50	7.20	3.60	8.00	11.10	89.20
4590						1842.00								0.05	10.90	5.00	6.70	5.90	10.50	92.10
4600														1.00	1.10	0.20	6.60	6.20	10.50	92.00
4700						1860.00								0.60	1.00	0.20	6.60	5.90	10.50	93.30
4800														0.80	1.60	0.20	6.60	5.90	10.60	92.50
4900						1860.00								0.90	1.66	0.20	6.50	5.60	10.50	94.50
5020														0.70	1.40	0.10	6.60	5.30	10.53	96.00
5100														0.10	1.40	0.10	6.60	5.60	10.50	94.70
5200														0.90	1.00	0.10	6.60	5.70	10.60	94.95
5300														1.30	1.70	0.10	6.70	5.60	10.30	92.70
5400														1.30	1.60	0.10	6.70	6.70	10.30	91.40
5500														1.00	1.30	0.10	6.70	6.20	10.30	89.40
5600														0.80	1.40	0.10	6.70	5.70	10.30	87.60
5700						1800.00								0.70	1.30	0.10	6.00	5.00	10.20	82.00
[illegible]														0.70	1.30	0.10	6.00	6.10	10.20	76.10
5900														0.80	1.10	0.10	6.00	6.30	10.20	75.40
6000														0.70	1.20	0.10	6.09	5.10	10.20	75.40
6100														0.60	1.30	0.10	6.00	4.90	10.10	75.00
6200														0.60	1.10	0.10	6.00	5.20	10.10	74.20
6300														0.70	1.00	0.10	6.00	4.80	10.10	73.30
6400														0.70	1.00	0.10	6.00	4.70	15.10	72.00
6500														0.60	1.00	0.40	3.50	6.00	14.76	38.90
6600																				
6700																				
6800																				
6900																				
7000																				
7100																				
7200																				
7300																				
7400																				
7500																				
7600																				
7700																				
7800																				
7900																				

Test Number	T-18		Run #
Temperature	500 Deg F	Heat-up Start	17
Time	6 Hours	Steady State Start	25
Date of Test	13-Sept.-89	Steady State Stop	31
		Test End	82

Range #1 425..431
Range #2 417..431
Range #3 417..482

Elapsed Time	Air Heater Inlet Damper Position	Air Heater Inlet Air Flow	Air Heater Temp	After Burner Inlet Temp	Building Draft	After Burner Exit Temp	Air Heater Gas Pressure	Air Heater Burner Pressure	After Burner Gas Pressure	After Burner Pressure	Propane Tank Temp	Propane Line Pressure	Propane Line Temp	Air Heater Exit THC	Flash Chamber Exit THC	After Burner Exit THC	After Burner Exit CO2	After Burner Exit CO	After Burner Exit O2	After Burner Exit NOx
	HIC-201	FI-202	TIC-304	TI-224	PIC-221	TIC-324	PI-303	PI-310	PI-323	PI-330										
(Hours)		(IWG)	(Deg F)	(Deg F)	(IWG)	(Deg F)	(PSIG)	(PSIG)	(PSIG)	(PSIG)	(Deg F)	(PSIG)	(Deg F)	(ppm/v)	(ppm/v)	(ppm/v)	(%)	(ppm/v)	(%)	(ppm/v)
Steady State Values																				
Data Range #1																				
Data Pts	4	4	5	4	4	4	3	3	3	3	3	3	3	4	4	5	5	5	5	5
Total	230.20	3.22	4465.00	1626.96	-0.19	8607.00	46.20	7.80	42.60	22.80	192.70	56.00	371.00	99.00	81.00	0.40	43.70	22.40	38.70	391.10
Mean	57.55	0.81	893.00	406.50	-0.05	2401.75	15.40	2.60	14.20	7.60	64.00	18.67	123.67	24.75	20.25	0.08	8.74	4.48	7.74	78.22
Maximum	60.00	0.87	1048.00	423.00	-0.03	2820.00	16.00	2.70	14.40	7.70	65.00	19.00	125.00	36.40	27.00	0.10	10.00	6.56	11.70	116.00
Minimum	56.10	0.74	819.00	387.00	-0.07	1986.00	15.00	2.50	14.00	7.50	63.00	18.50	122.00	1.20	4.00	0.00	5.80	2.60	5.80	33.40
Heat-up + Steady State Values																				
Data Range #2																				
Data Pts	12	12	13	12	12	12	11	11	11	11	11	11	11	11	11	13	13	13	13	13
Total	680.60	9.80	11622.00	3975.00	-0.62	33313.00	172.30	25.20	156.80	83.10	677.00	205.50	1363.00	295.20	223.40	1.00	106.50	57.80	110.50	861.80
Mean	56.56	0.82	894.00	331.25	-0.05	1937.43	15.66	2.29	14.25	7.55	61.55	18.68	123.91	26.84	20.07	0.14	8.19	4.45	8.50	66.60
Maximum	60.00	0.88	1107.00	421.00	-0.01	2080.00	16.50	3.20	14.40	7.70	65.00	19.00	127.00	36.40	31.50	0.20	10.00	7.00	11.70	116.80
Minimum	50.20	0.67	461.00	177.00	-0.08	1010.00	15.00	1.00	14.00	7.40	56.00	18.50	120.00	1.20	0.00	0.00	5.30	2.00	5.00	43.70
Total Treatment Values																				
Data Range #3																				
Data Pts	15	15	22	15	15	22	13	12	14	14	14	14	14	62	62	64	64	61	64	64
Total	796.70	11.16	11720.00	4322.00	-1.02	41646.00	172.30	25.20	200.56	106.30	858.00	261.00	1751.06	368.60	338.55	23.30	433.00	349.40	647.20	5603.00
Mean	53.66	0.74	533.60	288.13	-0.07	1560.27	13.25	2.10	14.35	7.59	61.29	18.79	125.07	5.95	5.46	0.36	6.86	5.46	10.11	88.00
Maximum	60.00	0.88	1191.00	421.00	-0.01	2520.00	16.50	3.20	15.00	7.90	65.00	19.50	133.00	36.40	31.50	7.20	10.00	11.50	14.70	121.00
Minimum	34.90	0.30	0.00	103.00	-0.18	1781.00	0.00	0.60	14.00	7.40	56.64	18.50	120.00	0.50	0.00	0.00	3.50	1.00	5.00	36.90

Test Number	T-10		Box 8		
Temperature	500 Deg F	Heat-up Start	17		
Time	6 Hours	Steady State Start	25	Range #1 425..451	
Date of Test	13-Sep-89	Steady State Stop	31	Range #2 417..431	
		Test End	36	Range #3 417..446	

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Roof	Box Exit Gas		Powder Box	Water	Floor	Hub		Middle Wall	Ship Rise	Clay Pipe	Rear Diffuser Bracket	Ship Rise	Steam Heated Riser
										Internal						Exterior Internal		External Internal		
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
0	313	182	263	176	317	213	318			272	327		178		266	318	170	283	331	273
100	326	184	284	195	324	225	331			285	346		180		284	323	185	307	250	266
200						245	377			323	367		210		312	361	228	348	282	290
300	440	240	290	230	304	287	454			407	332		250		331	451	283	427	353	452
400	486	285	320	255	339	306	469			440	362		286		438	487	330	473	403	481
500	530	361	406	305	401	354	521			458	382		352		461	541	401	507	473	493
600	558	381	422	324	423	358	527			500	464		373		493	555	490	512	485	490
700	563	405	449	346	446	374	537			518	422		398		511	571	505	537	505	518
800	564	427	458	363	452	386	541	500		531	428		440		524	567	530	534	520	533
900								505												
1000				370				510					460			560				
1100								530												
1200	565	440	471	378	464	390	544	514		530	430		470		519	565	530	541	530	530
1300	555		460	450	460	390	555	515		535	435		460		510	555	525	510	515	515
1400								530												
1500								540												
1600																				
1700																				
1800	265	300	250	215	230	235	210	230		325	370		356		250	290	300	260	290	250
1900								230												
2000																				
2100	212	166	207	171	171	184	181	179		201	220		270		207	216	221	190	213	219
2200	206	162	190	170	167	188	180	176		187	214		262		204	211	207	192	210	250
2300	190	160	260	155	165	190	185	170		185	206		250		180	205	190	190	200	185
2400																				
2500																				
2600																				
2700	177	145	175	154	152	163	150	156		170	180		200		181	178	172	166	177	176
2800																				
2900																				
3000																				
3100																				
3200	166	155	165	156	155	155	155	153		160	265		275		156	155	156	155	155	160
3300																				
3400																				
3500																				
3600	125	125	125	125	125	125	125	125		125	150		150		125	125	125	125	140	125
3700	125	130	130	130	130	130	120	130		130	140		140		130	130	130	130	130	130
3800																				
3900																				

DATA SHEET 4
PAGE 5 OF 6

Test Number T-10 — Run 1
Temperature 500 Deg F — Heat-up Start 17
Time 6 Hours — Steady State Start 25 — Range #1 425..431
Date of Test 13-Sep-90 — Steady State Stop 31 — Range #2 417..431
Test End 36 — Range #3 417..436

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Roof	Rec Exit Gas		Powder Box (Internal)	Rotor	Floor	Hub		Middle Wall	Skip Line (Exterior)	Clay Pipe (Internal)	Rear Diffuser Bracket	Skip Line (Internal)	Steam Heated Riser (Internal)	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
4000																					
4100																					
4200	115	115	115	115	115	115	115	115		115	125		115		115	115	115	115	115	115	
4300																					
4400																					
4550	126	115	125	109	107	113	112	111		114	120		131		113	122	114	113	118	118	
4600																					
4700													130								
4800																					
4900																					
5000	110	110	110	110	110	110	110	110		110	115		115		110	110	110	110	110	110	
5100																					
5200																					
5300																					
5400																					
5500	110	110	110	110	110	110	110	110		110	120		120		110	110	110	110	110	110	
5600																					
5700																					
5800																					
5900																					
6000	106	105	106	106	106	106	106	105		106	106		106		106	106	105	106	106	106	
6100	100	106	100	100	100	106	100	100		100	120		120		100	100	100	100	100	100	
6200																					
6300																					
6400																					
6500																					
6600																					
6700	90	94	110	98	93	106	101	90		95	96		97		104	94	90	103	101	102	
6800																					
6900	76	86	104	97	82	86	96	63		80	65		67		96	86	90	97	90	100	
7050																					
7100																					
Steady State Values Data Range #1																					
Data Pts	3	3	3	4	3	3	3	7	0	3	3	0	4	0	3	4	3	3	3	3	0

Test Number	T-18
Temperature	500 Deg F
Time	6 Hours
Date of Test	13-Sep-88

Run #		
Heat-up Start	17	
Steady State Start	25	Range #1 d25..d31
Steady State Stop	31	Range #2 d17..d31
Test End	46	Range #3 d17..d46

Elapsed Time	Diffuser Support	Rear Floor	Rear Wall	Floor Right Side	Diffuser	Exit Gas	Roof	Box Exit Gas		Pucker Box	Motor	Floor	Hub		Middle Wall	Skip Line	Clay Pipe	Near Diffuser Bracket	Skip Line	Steam Heated Riser	
											Internal					Exterior	Internal		Internal	Internal	
(Hours)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	
Mean	561	438	463	360	459	381	547	513	[illegible]	531	434	[illegible]	456	[illegible]	516	563	530	520	521	523	[illegible]
Maximum	565	419	471	450	464	396	555	520	[illegible]	536	438	[illegible]	470	[illegible]	524	567	538	541	529	533	[illegible]
Minimum	556	427	458	363	452	366	541	505	[illegible]	525	420	[illegible]	440	[illegible]	510	556	525	510	515	515	[illegible]
Heat-up + Steady State Values																					
Data Range #2																					
Data Pts	10	9	10	11	11	11	11	16	0	11	11	0	12	0	11	12	11	11	11	11	0
Total	4922	2923	3688	3373	3730	3532	5174	3532	0	4463	3956	0	4066	0	4715	5050	4883	4996	4555	4799	0
Mean	492	325	369	307	339	321	470	239	0	412	360	[illegible]	339	[illegible]	429	468	444	454	414	436	[illegible]
Maximum	568	449	471	450	464	398	555	520	0	538	438	[illegible]	470	[illegible]	524	572	530	511	529	533	[illegible]
Minimum	313	183	280	178	0	313	318	0	0	272	227	[illegible]	178	[illegible]	268	313	190	293	231	243	[illegible]
Total Treatment Values																					
Data Range #3																					
Data Pts	26	25	26	27	27	27	27	33	0	27	27	1	28	1	27	33	27	27	27	27	0
Total	7216	4918	5097	5482	5837	5836	7336	6285	0	7185	6514	0	7009	0	6932	8238	7224	7255	6933	7142	0
Mean	277	197	231	203	216	216	272	190	0	266	241	0	242	0	259	296	268	269	257	265	[illegible]
Maximum	568	448	471	450	464	396	555	520	0	538	438	0	470	0	524	572	530	541	529	533	[illegible]
Minimum	94	64	109	87	0	86	95	0	0	60	65	0	67	0	96	80	90	97	90	100	[illegible]

APPENDIX E

HOURLY AVERAGES FOR CEM SYSTEM DATA

Appendix E provides hourly averages of data collected by the coutinuous emissions monitoring (CEM) system. The following information is provided:

- Afterburner Outlet
  - Oxygen (O_2) concentration
  - Carbon Monoxide (CO) concentration
  - Nitrous Oxides (NO_x) concentration
  - Total Hydrocarbons (THC) concentration
  - Carbon Dioxide (CO_2) concentration
- Flash Chamber Inlet
  - Total Hydrocarbons (THC)
- Flash Chamber Outlet
  - Total Hydrocarbons (THC)

Two hydrocarbon analyzers were used to monitor total hydrocarbons: one analyzer continuously monitored emissions from the afterburner outlet; the other analyzer intermittently monitored emissions from the flash chamber inlet and outlet on a time sharing basis.

Several data gaps exist for various time periods in the CEM data presented in this Appendix. These data gaps are a result of power failures (usually from lightning events in the Hawthorne area) to the data logger system used to continuously record instrument readings. The data for these time periods were, however, recorded on a strip chart recorder. A review of the strip chart printout indicated that the data for these time periods are consistent with those presented herein.

TEST RUN 2
400°F/24 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/25/89
Test #: 2

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:11-00:59	11.2	5.4	50.8	<0.1	6.2	<0.1	2.1
01:00-01:59	11.2	5.7	49.3	<0.1	6.2	<0.1	2.1
02:00-02:59	11.2	5.6	49.1	<0.1	6.2	<0.1	2.1
03:00-03:59	11.2	5.7	50.4	<0.1	6.2	<0.1	2.1
04:00-04:59	11.2	5.4	51.2	<0.1	6.1	<0.1	2.0
05:00-05:59	11.2	5.4	51.4	<0.1	6.2	<0.1	2.0
06:00-06:59	11.2	5.3	51.2	<0.1	6.1	<0.1	2.0
07:00-07:59	11.3	6.0	51.8	<0.1	6.1	<0.1	2.0
08:00-08:40	11.3	6.8	52.7	<0.1	6.1	<0.1	24.5

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/26/89
Test #: 2

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
15:37-15:59	12.3	6.5	72.6	1.0	5.4	1.0	2.1
16:00-16:59	12.0	6.4	74.0	0.6	5.6	1.3	2.3
17:00-17:59	12.2	6.4	69.6	0.2	5.5	1.0	2.3
18:00-18:59	12.2	6.2	66.0	0.1	5.4	0.6	2.3
19:00-19:59	12.3	5.9	63.7	<0.1	5.4	0.9	1.7
20:00-20:59	12.4	5.5	64.7	<0.1	5.4	0.6	1.6
21:00-21:59	12.5	5.6	63.8	<0.1	5.3	0.7	1.5
22:00-22:59	12.6	5.8	60.6	<0.1	5.2	0.5	1.7
23:00-23:59	12.7	6.0	59.6	<0.1	5.1	0.7	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/27/89
Test #: 2

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.7	6.0	58.8	<0.1	5.1	0.6	1.5
01:00-01:59	12.7	6.1	57.0	<0.1	5.1	0.6	1.4
02:00-02:59	12.9	6.3	55.6	<0.1	5.0	0.5	1.5
03:00-03:59	13.0	6.6	54.2	<0.1	4.9	0.3	1.7
04:00-04:59	13.1	6.8	55.7	<0.1	4.8	0.7	1.1
05:00-05:59	13.1	6.7	54.9	<0.1	4.8	0.5	1.4
06:00-06:59	13.2	6.8	54.3	<0.1	4.8	0.3	1.5
07:00-07:59	13.3	7.6	53.3	<0.1	4.7	0.6	1.4
08:00-08:59	13.4	8.9	52.5	0.2	4.6	0.8	2.1
09:00-09:28	13.4	9.1	52.6	0.2	4.6	0.5	2.6
10:37-10:59	13.3	9.1	52.4	0.6	4.5	1.0	2.6
11:00-11:59	13.4	8.8	53.1	0.4	4.5	0.8	2.9
12:00-12:59	13.4	8.7	53.8	0.3	4.5	0.6	2.3
13:00-13:59	13.4	8.7	53.7	0.2	4.4	0.8	2.6
14:00-14:59	13.4	8.7	54.1	0.2	4.4	1.0	2.4
15:00-15:59	13.4	8.6	54.0	0.2	4.5	0.5	2.6
16:00-16:59	13.3	8.4	53.7	0.1	4.5	1.1	2.1
17:00-17:59	12.9	7.8	55.5	0.1	4.8	0.8	2.2
18:00-18:59	12.9	7.6	55.1	<0.1	4.8	0.9	2.0
19:00-19:59	13.2	7.9	52.5	<0.1	4.6	0.6	2.0
20:00-20:59	13.0	7.4	51.7	<0.1	4.7	0.4	1.8
21:00-21:59	13.3	7.8	49.1	<0.1	4.5	0.7	1.5
22:00-22:59	13.3	7.8	51.9	<0.1	4.5	0.4	1.5
23:00-23:59	13.4	7.7	51.4	<0.1	4.4	0.6	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/28/89
Test #: 2

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	13.4	7.6	49.4	<0.1	4.4	0.5	1.6
01:00-01:59	13.4	7.7	48.8	<0.1	4.4	0.3	1.7
02:00-02:59	13.4	7.6	48.7	<0.1	4.4	0.6	1.4
03:00-03:59	13.4	7.4	49.3	<0.1	4.4	0.4	1.5
04:00-04:59	13.5	7.6	50.0	<0.1	4.4	0.6	1.4
05:00-05:59	13.5	7.7	50.2	<0.1	4.4	0.4	1.2
06:00-06:59	13.5	7.5	49.8	<0.1	4.4	0.2	1.2
07:00-07:44	13.5	7.7	50.3	<0.1	4.4	0.9	1.2
08:51-08:59	19.6	6.6	0.3	1.5	0.1	<0.1	1.9
09:00-09:59	19.6	6.9	0.3	1.6	<0.1	1.1	3.1
10:00-10:59	19.6	6.7	0.3	1.3	<0.1	0.7	3.0
11:00-11:59	19.6	6.7	0.2	1.3	<0.1	1.1	2.5
12:00-12:59	19.6	6.6	0.3	1.2	<0.1	1.1	2.4
13:00-13:59	19.6	6.7	0.3	1.2	<0.1	0.7	2.8
14:00-14:59	19.6	6.7	0.2	1.3	<0.1	1.1	2.4
15:00-15:59	19.6	6.5	0.2	1.3	<0.1	0.9	2.4
16:00-16:59	19.6	6.4	0.2	1.2	<0.1	1.0	2.2
17:00-17:59	19.7	6.4	0.2	1.5	<0.1	0.8	2.2
18:00-18:59	19.6	6.3	0.3	17.0	<0.1	0.6	2.5
19:00-19:59	19.1	17.1	3.2	1.7	0.5	0.9	2.1
20:00-20:59	18.2	22.1	8.3	1.1	1.2	0.5	2.0
21:00-21:59	18.0	22.8	9.2	1.0	1.3	0.8	1.6
22:00-22:59	18.0	22.9	9.0	1.1	1.3	0.7	1.7
23:00-23:59	18.0	22.7	8.9	1.0	1.3	0.8	1.6

TEST RUN 3
500°F/36 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/19/89
Test #: 3

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.0	5.8	64.9	<0.1	5.9	0.4	<0.1
01:00-01:59	12.4	6.1	59.6	<0.1	5.6	0.3	<0.1
02:00-02:59	12.5	6.3	58.8	<0.1	5.6	0.2	<0.1
03:00-03:59	12.6	6.1	58.4	<0.1	5.6	0.2	<0.1
04:00-04:59	12.5	5.8	58.4	<0.1	5.7	0.1	<0.1
05:00-05:59	12.4	5.5	57.9	<0.1	5.7	<0.1	<0.1
06:00-06:59	12.5	5.6	56.4	<0.1	5.7	<0.1	<0.1
07:00-07:59	17.8	17.4	12.0	0.8	1.3	0.1	<0.1
08:00-08:59	13.5	9.9	50.4	0.1	5.0	0.2	<0.1
09:00-09:59	13.0	7.8	60.6	0.2	5.3	0.8	8.4
10:00-10:59	12.8	7.7	63.6	0.1	5.5	0.3	3.5
11:00-11:59	12.4	7.6	67.8	<0.1	5.8	0.9	2.1
12:00-12:59	11.7	7.8	75.8	<0.1	6.5	0.4	3.2
13:00-13:59	9.0	17.6	98.5	4.1	4.8	13.5	11.9
14:00-14:59	11.2	8.4	78.1	0.5	6.2	0.9	3.8
15:00-15:59	11.3	8.1	78.6	0.2	6.4	0.6	3.6
16:00-16:59	11.4	7.6	77.7	<0.1	6.5	1.1	2.7
17:00-17:59	11.4	7.5	78.8	<0.1	6.5	0.8	2.3
18:00-18:59	11.3	7.4	79.9	<0.1	6.6	0.5	3.0
19:00-19:50	11.2	6.8	76.4	<0.1	6.6	1.2	2.1

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/23/89
Test #: 3

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
20:49-20:59	17.5	24.7	11.6	1.2	1.6	1.6	6.1
21:00-21:59	17.6	24.1	11.1	0.8	1.5	1.2	2.3
22:00-22:59	17.5	24.0	11.0	0.7	1.5	0.8	2.1
23:00-23:59	17.1	24.7	13.2	0.7	1.8	1.2	1.7

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/24/89
Test #: 3

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	16.3	24.4	17.0	0.4	2.3	0.8	1.9
01:00-01:59	15.4	20.3	22.0	<0.1	3.0	0.9	1.5
02:00-02:59	14.5	13.5	28.5	<0.1	3.7	0.9	1.4
03:00-03:59	13.4	8.2	38.3	<0.1	4.5	0.7	1.6
04:00-04:59	12.2	6.3	51.4	<0.1	5.4	0.8	1.4
05:00-05:59	11.1	5.5	64.0	<0.1	6.1	0.7	1.5
06:00-06:59	10.0	5.4	78.6	<0.1	7.0	0.7	1.5
07:00-06:59	9.7	5.4	83.9	<0.1	7.2	<0.1	1.2

TEST RUN 5
500°F/24 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/29/89
Test #: 5

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	17.6	23.4	11.0	1.1	1.5	0.5	1.7
01:00-01:59	16.9	24.3	14.1	1.3	1.9	0.4	1.6
02:00-02:59	16.2	24.4	16.9	1.1	2.5	0.7	1.4
03:00-03:59	15.3	23.2	19.2	0.8	2.7	0.7	1.5
04:00-04:59	14.9	16.5	27.2	0.3	3.4	0.6	1.5
05:00-05:59	14.1	11.7	35.3	0.1	4.0	0.4	1.5
06:00-06:59	13.2	8.1	46.6	<0.1	4.7	0.7	1.7
07:00-07:59	12.2	6.1	63.4	<0.1	5.4	0.7	1.5
08:00-08:29	11.4	6.1	76.3	0.1	5.9	0.6	1.7

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/30/89
Test #: 5

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
18:18-18:59	12.4	8.8	75.3	0.4	5.3	1.0	2.1
19:00-19:59	12.3	5.7	74.3	0.1	5.4	0.6	2.3
20:00-20:59	12.2	5.5	72.2	<0.1	5.4	0.9	1.7
21:00-21:59	12.3	5.4	66.9	<0.1	5.3	0.9	1.5
22:00-22:59	12.4	5.4	62.8	<0.1	5.2	0.6	1.6
23:00-23:59	12.5	5.7	59.8	<0.1	5.2	0.4	1.7

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/31/89
Test #: 5

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:25	12.5	6.0	58.5	<0.1	5.2	1.3	1.3
16:32-16:59	16.3	22.6	18.0	1.2	2.5	2.6	3.7
17:00-17:59	15.7	19.7	22.1	0.7	3.0	0.5	2.1
18:00-18:59	14.9	14.0	29.7	0.2	3.5	0.9	1.7
19:00-19:59	14.0	8.5	41.8	<0.1	4.1	0.9	1.5
20:00-20:59	12.7	5.4	59.3	<0.1	5.1	0.6	1.5
21:00-21:59	13.5	5.8	58.8	<0.1	4.5	0.4	1.4
22:00-22:59	13.5	5.8	57.4	<0.1	4.5	0.6	1.2
23:00-23:59	13.4	5.7	57.4	<0.1	4.6	0.4	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/01/89
Test #: 5

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	13.4	5.6	56.1	<0.1	4.6	0.5	1.2
01:00-01:59	13.5	5.6	55.5	<0.1	4.5	0.3	1.3
02:00-02:59	13.4	5.6	55.6	<0.1	4.6	0.6	1.1
03:00-03:59	13.5	5.7	55.0	<0.1	4.5	0.4	1.2
04:00-04:59	13.5	6.0	55.4	<0.1	4.5	0.5	1.2
05:00-05:59	13.5	6.1	55.3	<0.1	4.5	0.4	1.3
06:00-06:52	13.5	5.9	55.4	<0.1	4.5	0.3	1.1
09:03-09:59	19.3	9.4	2.1	6.7	0.3	0.9	1.9
10:00-10:59	18.3	20.1	8.1	1.0	1.0	0.7	2.0
11:00-11:59	18.1	21.0	9.2	0.9	1.1	0.9	2.0
12:00-12:59	18.1	21.2	9.1	1.0	1.1	0.6	2.3
13:00-13:59	18.1	21.0	9.0	1.2	1.1	1.1	2.0
14:00-14:59	17.9	21.7	10.3	1.2	1.3	1.0	1.5
15:00-15:35	13.3	24.5	60.6	2.6	2.4	1.5	11.9
08:39-08:59	13.6	7.7	33.4	0.1	4.5	0.4	3.1
09:00-09:59	13.6	7.4	0.2	0.1	4.5	0.8	1.7
10:00-10:59	13.0	9.7	22.5	0.2	4.6	0.5	1.9
11:00-11:59	12.1	10.3	80.9	0.6	4.0	1.6	3.4
12:00-12:59	13.7	8.6	53.5	0.4	4.4	1.0	2.2
13:00-13:22	13.7	8.2	53.8	0.3	4.4	0.5	3.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/02/89
Test #: 5

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
08:44-08:59	19.6	5.7	0.2	1.3	0.2	0.6	1.7
09:00-09:59	13.4	12.9	71.5	4.0	1.5	1.4	9.6
10:00-10:59	19.6	5.4	0.3	<0.1	0.2	10.7	<0.1
11:00-11:59	19.6	5.6	0.3	<0.1	0.2	<0.1	<0.1
12:00-12:59	19.6	5.7	0.3	<0.1	0.3	<0.1	<0.1
13:00-13:59	19.6	5.6	0.3	<0.1	0.2	<0.1	<0.1
14:00-14:59	19.6	5.4	0.3	<0.1	0.2	<0.1	<0.1
15:00-15:52	19.2	5.5	0.3	<0.1	0.2	<0.1	<0.1
16:29-16:59	19.6	5.3	0.3	<0.1	0.2	<0.1	<0.1
17:00-17:59	19.6	5.2	0.4	<0.1	0.2	<0.1	<0.1
18:00-18:59	19.6	5.2	0.3	<0.1	0.2	<0.1	<0.1
19:00-19:59	19.6	5.0	0.3	<0.1	0.2	<0.1	<0.1
20:00-20:59	19.6	4.7	0.3	<0.1	0.2	<0.1	<0.1
21:00-21:59	19.6	4.6	0.2	<0.1	0.2	<0.1	<0.1
22:00-22:59	19.6	4.5	0.2	<0.1	0.2	<0.1	<0.1
23:00-23:59	19.6	4.3	0.2	<0.1	0.2	<0.1	<0.1

TEST RUN 8
400°F/36 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/03/89
Test #: 8

Test Time	Afterburner Outlet O_2 (%)	Afterburner Outlet CO (ppm)	Afterburner Outlet NO_x (ppm)	Afterburner Outlet THC (ppm)	Afterburner Outlet CO_2 (%)	Flash Chamber Inlet THC (ppm)	Flash Chamber Outlet THC (ppm)
00:00-00:59	19.6	4.4	0.2	<0.1	0.2	<0.1	<0.1
01:00-01:59	19.6	4.4	0.2	<0.1	0.2	<0.1	<0.1
02:00-02:59	19.6	4.3	0.2	<0.1	0.2	<0.1	<0.1
03:00-03:59	19.6	4.5	0.2	<0.1	0.2	<0.1	<0.1
04:00-04:59	19.6	4.3	0.2	<0.1	0.2	<0.1	<0.1
05:00-05:59	19.6	4.3	0.1	<0.1	0.2	<0.1	<0.1
06:00-06:59	19.6	4.3	<0.1	<0.1	0.2	<0.1	<0.1
07:00-07:59	19.6	4.4	<0.1	<0.1	0.2	<0.1	<0.1
08:11-08:59	10.5	19.1	102.2	8.5	3.0	<0.1	5.0
09:00-09:59	19.1	7.5	0.3	1.2	0.5	17.8	12.0
10:00-10:59	19.6	5.2	0.3	1.1	0.2	0.9	2.1
11:00-11:59	19.6	5.4	0.2	9.2	0.2	0.7	3.4
12:00-12:59	18.3	21.3	7.1	3.2	1.1	1.0	2.7
13:00-13:59	18.0	23.4	9.1	1.4	1.3	0.8	2.3
14:00-14:59	18.0	23.2	9.1	1.3	1.3	0.9	2.1
15:00-15:59	18.0	22.8	9.0	1.2	1.3	0.6	2.2
16:00-16:59	17.8	23.2	10.1	1.3	1.4	0.9	1.4
17:00-17:59	17.2	24.9	12.8	1.8	1.8	0.7	1.9
18:00-18:59	16.4	26.2	15.3	1.8	2.3	0.5	1.8
19:00-19:59	15.6	23.8	19.4	0.9	2.9	0.7	1.5
20:00-20:59	14.9	16.7	26.9	0.3	3.5	0.7	1.4
21:00-21:59	13.8	9.4	39.1	<0.1	4.2	0.5	1.4
22:00-22:59	12.6	6.1	57.9	<0.1	5.0	0.7	1.3
23:00-23:59	11.0	4.6	54.4	<0.1	6.2	21.4	12.7

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/04/89
Test #: 8

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.0	4.5	57.0	<0.1	6.8	32.8	26.8
01:00-01:59	9.9	4.7	57.0	<0.1	6.9	35.7	28.9
02:00-02:59	10.0	4.8	56.9	<0.1	6.8	38.2	35.6
03:00-03:59	10.0	5.0	58.0	<0.1	6.8	62.1	48.2
04:00-04:59	10.9	5.1	54.0	<0.1	6.2	59.6	43.5
05:00-05:59	11.3	5.1	53.3	<0.1	6.0	61.2	43.5
06:00-06:59	10.5	4.8	59.0	<0.1	6.5	59.8	45.0
07:00-07:59	10.5	5.1	59.8	<0.1	6.5	58.1	44.1
08:00-08:59	10.6	5.8	72.8	<0.1	6.5	55.3	45.3
09:00-09:59	9.8	11.5	86.6	3.4	5.6	49.9	39.5
10:00-10:59	10.8	6.2	55.6	0.2	6.4	48.6	38.8
11:00-11:59	10.8	6.0	55.8	0.1	6.4	47.9	36.6
12:00-12:59	10.9	6.1	55.9	0.1	6.3	46.7	35.8
13:00-13:59	10.9	6.1	55.7	0.1	6.3	45.5	35.3
14:00-14:59	10.9	6.2	56.7	0.1	6.3	44.8	34.2
15:00-15:59	10.9	6.1	57.0	0.1	6.3	43.6	34.0
16:00-16:59	10.9	5.9	56.8	<0.1	6.2	43.9	33.5
17:00-17:59	10.8	5.7	57.0	<0.1	6.3	44.0	34.3
18:00-18:59	10.7	5.8	56.9	<0.1	6.3	45.7	34.7
19:00-19:59	10.7	5.7	56.5	<0.1	6.4	47.2	35.5
20:00-20:59	10.7	5.1	54.7	<0.1	6.4	50.5	38.5
21:00-21:59	10.7	5.0	56.0	<0.1	6.4	51.0	39.0
22:00-22:59	10.6	5.4	56.3	<0.1	6.5	50.0	38.8
23:00-23:59	10.6	5.1	56.1	<0.1	6.4	50.0	38.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 06/05/89
Test #: 8

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.6	5.0	55.7	<0.1	6.5	51.5	40.4
01:00-01:59	10.5	5.1	54.8	<0.1	6.5	54.6	43.3
02:00-02:59	10.5	5.3	54.3	<0.1	6.5	56.2	44.9
03:00-03:59	10.5	5.3	55.6	<0.1	6.5	56.5	44.7
04:00-04:59	10.5	5.3	56.5	<0.1	6.6	55.4	44.5
05:00-05:59	10.5	5.2	56.1	<0.1	6.6	55.8	44.3
06:00-06:59	10.4	5.0	56.3	<0.1	6.6	56.8	44.8
07:00-07:59	10.5	5.2	56.3	<0.1	6.6	56.3	43.7
08:00-08:59	10.6	5.6	56.9	<0.1	6.5	48.3	37.5
09:00-09:59	9.8	10.9	96.1	3.6	5.2	51.5	40.8
10:00-10:59	11.2	5.2	58.0	<0.1	6.2	45.4	36.5
11:00-11:59	11.2	5.3	58.7	<0.1	6.2	44.0	34.8
12:00-12:59	11.2	5.4	59.5	<0.1	6.2	43.3	33.5
13:00-13:59	11.2	5.5	59.1	<0.1	6.1	42.1	33.1
14:00-14:59	11.2	5.7	59.4	0.1	6.1	42.2	32.1
15:00-15:59	11.2	5.6	59.9	<0.1	6.1	40.6	32.2
16:00-16:59	11.3	5.2	58.8	<0.1	6.1	41.8	32.0
17:00-17:59	11.3	5.0	59.2	<0.1	6.0	40.0	31.2
18:00-18:59	13.5	6.1	63.2	0.2	4.5	1.2	2.1
19:00-19:59	12.4	5.2	67.0	<0.1	5.3	0.9	1.6
20:00-20:04	12.5	5.2	62.1	<0.1	5.2	0.5	6.0

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/06/89
Test #: 8

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
09:32-09:59	13.2	6.2	58.9	0.2	4.8	10.0	23.6
10:00-10:59	11.0	10.1	90.3	4.4	4.1	0.7	2.6
11:00-11:19	13.1	5.9	59.0	<0.1	4.8	0.6	1.5
14:30-14:59	13.3	5.6	47.4	<0.1	4.8	0.9	1.0
15:00-15:59	13.3	5.6	48.1	<0.1	4.8	0.6	1.4
16:00-16:59	13.0	5.0	50.4	<0.1	5.0	0.5	1.3
17:00-17:59	12.2	3.7	58.2	<0.1	5.6	0.6	1.1
18:00-18:59	12.2	3.8	56.1	<0.1	5.6	0.5	1.2
19:00-19:59	12.3	4.0	55.6	<0.1	5.5	0.7	1.1
20:00-20:59	12.3	4.0	56.5	<0.1	5.5	0.5	1.1
21:00-21:59	12.3	4.1	56.2	0.1	5.5	0.4	1.0
22:00-22:59	12.2	4.4	58.5	0.5	5.5	0.6	1.0
23:00-23:59	12.3	4.5	55.4	0.2	5.5	0.7	1.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/07/89
Test #: 8

Test Time	Afterburner Outlet O_2 (%)	Afterburner Outlet CO (ppm)	Afterburner Outlet NO_x (ppm)	Afterburner Outlet THC (ppm)	Afterburner Outlet CO_2 (%)	Flash Chamber Inlet THC (ppm)	Flash Chamber Outlet THC (ppm)
00:00-00:59	12.3	4.4	53.6	<0.1	5.5	0.5	1.2
01:00-01:59	12.2	4.3	54.3	<0.1	5.6	0.6	1.3
02:00-02:59	12.1	4.3	54.5	<0.1	5.6	0.6	1.2
03:00-03:59	12.2	4.3	54.5	<0.1	5.6	0.5	1.3
04:00-04:59	12.2	4.4	54.5	<0.1	5.5	0.4	1.4
05:00-05:59	13.3	4.4	46.1	0.2	4.7	0.7	1.2
06:00-06:21	19.6	4.2	<0.1	1.1	0.3	0.7	1.3
09:51-09:53	11.8	4.8	70.0	0.1	5.8	<0.1	7.7
13:58-13:59	11.5	3.4	64.2	0.1	6.2	<0.1	0.8
14:05-14:22	12.1	3.8	60.7	<0.1	5.7	0.8	1.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/08/89
Test #: 8

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
08:37-08:59	19.9	4.4	5.2	5.2	0.4	0.7	2.5
09:00-09:15	17.0	5.0	2.3	23.4	0.4	<0.1	26.5
12:33-12:59	18.1	19.4	5.1	1.0	0.9	<0.1	<0.1
13:00-13:48	17.5	21.3	8.7	0.6	1.3	<0.1	<0.1

TEST RUN 13
500°F/12 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/09/89
Test #: 13

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
20:26-20:59	14.5	18.2	24.4	<0.1	3.4	<0.1	<0.1
21:00-21:59	14.1	13.5	30.4	<0.1	3.7	<0.1	<0.1
22:00-22:59	13.0	7.9	45.2	<0.1	4.5	<0.1	<0.1
23:00-23:59	11.7	4.2	64.2	<0.1	5.3	<0.1	<0.1

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/10/89
Test #: 13

Test Time	Afterburner Outlet O_2 (%)	Afterburner Outlet CO (ppm)	Afterburner Outlet NO_x (ppm)	Afterburner Outlet THC (ppm)	Afterburner Outlet CO_2 (%)	Flash Chamber Inlet THC (ppm)	Flash Chamber Outlet THC (ppm)
00:00-00:59	10.0	3.8	73.6	<0.1	6.5	[illegible]	7.9
01:00-01:59	9.3	3.7	52.8	<0.1	7.0	28.4	[illegible]
02:00-02:59	9.0	3.7	52.9	<0.1	7.2	49.4	35.1
03:00-03:59	7.8	3.6	55.5	<0.1	8.0	71.8	50.8
04:00-04:59	7.2	3.5	62.2	<0.1	8.5	59.2	42.1
05:00-05:59	7.1	3.6	[illegible]	<0.1	8.5	46.0	31.0
06:00-06:59	7.3	3.8	65.3	<0.1	8.4	44.6	31.5
07:00-07:59	7.7	4.0	56.6	<0.1	8.1	33.9	24.4
08:00-08:59	7.5	4.2	52.5	<0.1	8.3	47.0	24.2
09:00-09:59	8.0	4.7	49.1	<0.1	7.9	53.1	31.9
10:00-10:59	8.4	4.7	49.0	<0.1	7.6	51.9	26.8
11:00-11:40	8.0	9.9	72.8	1.5	6.7	43.9	26.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/11/89
Test #: 13

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
09:59-11:40	9.8	6.6	101.6	38.9	6.6	<0.1	46.5
10:00-10:59	8.6	18.9	119.6	8.1	6.6	<0.1	8.8
11:00-11:59	9.1	4.6	142.2	3.0	5.9	11.7	9.2
12:00-12:59	9.6	3.8	101.8	<0.1	7.2	0.9	1.0
13:00-13:59	9.6	3.9	102.3	<0.1	7.2	1.1	1.8
14:00-14:59	9.6	3.7	104.1	<0.1	7.2	1.1	1.8
15:00-15:59	9.5	3.7	105.7	<0.1	7.2	0.9	1.9
16:00-16:59	9.5	3.7	105.0	<0.1	7.2	0.7	1.6
17:00-17:59	9.5	3.7	105.9	<0.1	7.2	0.9	1.0
18:00-18:59	9.5	3.6	107.4	<0.1	7.2	0.6	1.7
19:00-19:59	9.4	3.3	108.0	<0.1	7.3	0.9	1.4
20:00-20:59	9.4	2.9	108.4	<0.1	7.3	0.5	1.4
21:00-21:59	9.1	2.8	109.3	<0.1	7.3	0.5	1.3
22:00-22:59	9.4	2.9	107.8	<0.1	7.3	0.5	1.3
23:00-23:59	9.4	3.0	104.3	<0.1	7.3	0.5	1.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/12/89
Test #: 13

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	9.4	2.9	102.0	<0.1	7.3	0.6	1.1
01:00-01:59	9.5	2.9	101.8	<0.1	7.3	0.5	1.2
02:00-02:59	9.5	2.9	102.2	<0.1	7.2	0.7	1.1
03:00-03:59	9.5	3.0	100.6	<0.1	7.2	0.5	1.2
04:00-04:59	9.5	3.0	101.7	<0.1	7.2	0.5	1.2
05:00-05:59	9.6	2.9	101.8	<0.1	7.2	0.4	1.3
06:00-06:59	9.6	2.8	101.0	<0.1	7.1	0.4	1.2
07:00-07:59	9.7	3.1	100.8	<0.1	7.1	0.5	1.2
08:00-08:59	9.9	3.6	100.6	<0.1	7.0	0.4	1.5
09:00-09:59	10.0	4.6	99.4	<0.1	6.9	0.7	1.6
10:00-10:59	9.7	8.5	107.5	4.4	5.8	8.1	8.3
11:00-11:59	10.0	3.7	98.7	<0.1	7.0	0.6	1.8
12:00-12:51	10.0	3.8	101.1	<0.1	6.9	0.5	1.6

TEST RUN 14
400°F/12 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/15/89
Test #: 14

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
07:58-07:59	19.3	4.2	<0.1	<0.1	0.2	<0.1	<0.1
08:00-08:59	13.1	20.6	106.0	7.8	3.6	4.9	5.2
09:00-09:59	19.4	5.3	1.4	7.4	0.4	0.7	2.0
10:00-10:59	18.5	20.7	5.9	2.6	1.0	10.9	11.0
11:00-11:59	18.0	21.9	6.3	2.2	1.3	0.5	3.4
12:00-12:59	18.1	21.5	8.2	1.7	1.3	0.4	2.3
13:00-13:59	18.1	21.3	8.1	1.4	1.3	0.4	2.0
14:00-14:59	17.9	22.1	9.4	1.6	1.4	0.4	1.9
15:00-15:59	17.3	24.1	12.0	2.4	1.8	0.4	1.6
16:00-16:59	16.5	25.6	14.1	2.4	2.3	0.4	1.9
17:00-17:59	15.8	22.5	19.4	1.6	2.8	0.5	1.9
18:00-18:59	15.0	16.8	27.8	0.9	3.4	0.5	1.8
19:00-19:59	13.9	10.0	41.9	0.3	4.2	0.5	1.4
20:00-20:59	12.7	5.3	63.5	<0.1	5.1	0.4	1.2
21:00-21:59	11.1	3.4	92.9	<0.1	6.2	4.2	1.1
22:00-22:59	10.5	3.7	53.5	<0.1	6.5	10.5	10.3
23:00-23:59	10.2	3.6	57.0	<0.1	6.8	23.5	23.6

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/16/89
Test #: 14

Test Time	Afterburner Outlet O_2 (%)	Afterburner Outlet CO (ppm)	Afterburner Outlet NO_x (ppm)	Afterburner Outlet THC (ppm)	Afterburner Outlet CO_2 (%)	Flash Chamber Inlet THC (ppm)	Flash Chamber Outlet THC (ppm)
00:00-00:59	9.1	3.3	57.4	<0.1	7.6	35.4	26.4
01:00-01:59	8.7	3.4	63.2	<0.1	7.9	38.2	28.7
02:00-02:59	8.8	3.4	68.9	<0.1	7.8	42.3	29.2
03:00-03:59	10.8	3.3	62.1	<0.1	6.4	57.7	44.2
04:00-04:59	10.8	3.1	63.1	<0.1	6.3	60.0	42.9
05:00-05:59	10.4	3.1	69.5	<0.1	6.6	59.9	43.1
06:00-06:59	10.4	3.3	53.2	<0.1	6.6	62.4	44.2
07:00-07:59	11.0	3.2	54.2	<0.1	6.3	51.3	37.1
08:00-08:59	11.2	9.6	77.7	6.0	5.4	43.4	35.6
09:00-09:59	9.5	3.9	63.2	<0.1	7.3	33.5	30.7
10:00-10:59	9.2	3.9	65.7	<0.1	7.5	31.8	26.2
11:00-11:59	9.2	3.9	67.6	<0.1	7.5	28.8	23.6
12:00-12:59	9.4	4.0	59.1	<0.1	7.4	26.0	21.1
13:00-13:59	9.4	4.2	70.7	<0.1	7.3	23.1	20.6
14:00-14:59	11.7	5.1	104.1	<0.1	5.7	1.4	2.1
15:00-15:59	12.1	4.2	89.4	<0.1	5.4	1.1	1.8
16:00-16:59	12.4	4.2	82.4	<0.1	5.2	0.7	2.0
17:00-17:59	12.4	4.1	76.4	<0.1	5.2	0.9	1.6
18:00-18:59	12.4	4.0	73.7	<0.1	5.2	0.8	1.5
19:00-19:59	12.5	3.7	70.4	<0.1	5.1	0.5	1.5
20:00-20:59	12.5	3.5	69.2	<0.1	5.1	0.4	1.4
21:00-21:59	12.6	3.5	67.7	<0.1	5.1	0.5	1.2
22:00-22:59	12.7	3.5	67.4	<0.1	5.0	0.6	1.1
23:00-23:59	12.7	3.8	66.8	<0.1	5.0	0.4	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/17/89
Test #: 14

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.7	4.0	65.4	<0.1	5.0	0.4	1.4
01:00-01:59	12.8	3.8	62.8	<0.1	4.9	0.5	1.2
02:00-02:59	12.8	4.1	62.2	<0.1	4.9	0.6	1.1
03:00-03:59	12.9	3.9	63.1	<0.1	4.8	0.4	1.2
04:00-04:59	13.0	3.9	61.5	<0.1	4.8	0.3	1.1
05:00-05:59	13.0	4.1	61.4	<0.1	4.8	0.5	1.0
06:00-06:59	13.0	3.9	61.0	<0.1	4.8	0.3	1.1
07:00-07:59	13.1	4.2	59.9	<0.1	4.7	0.4	1.0
08:00-08:59	11.5	4.3	78.1	<0.1	5.8	0.4	1.5
09:00-09:59	12.1	11.8	67.9	6.4	6.1	18.6	10.2
10:00-10:59	9.8	7.3	135.3	10.9	4.8	0.6	1.6
11:00-11:59	10.1	4.2	104.6	0.2	6.8	0.5	1.6
12:00-12:59	10.3	3.7	99.3	0.2	6.7	0.7	1.3
13:00-13:59	10.1	3.4	100.9	0.2	6.7	0.4	1.3
14:00-14:59	11.7	3.5	79.6	0.2	5.7	0.4	1.2
15:00-15:59	10.2	3.9	102.6	0.3	6.7	0.6	1.5
16:00-16:59	10.2	3.8	103.0	0.2	6.7	0.7	1.5
17:00-17:59	10.1	3.5	103.0	0.2	6.8	0.4	1.4
18:00-18:59	9.9	3.2	103.3	0.1	6.9	0.4	1.2
19:00-19:59	9.9	3.0	102.7	0.1	6.9	0.4	1.0
20:00-20:59	9.9	2.9	102.2	0.1	6.9	0.5	0.9
21:00-21:59	10.0	2.9	100.7	0.1	6.9	0.3	1.0
22:00-22:59	10.1	2.9	99.6	0.1	6.8	0.3	1.0
23:00-23:59	10.1	3.2	99.9	0.2	6.8	0.5	1.0

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/13/89
Test #: 14

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.1	3.2	98.9	0.2	6.8	0.3	1.1
01:00-01:59	10.1	3.1	98.0	0.2	6.8	0.4	1.0
02:00-02:59	10.2	3.1	97.6	0.2	6.8	0.3	0.9
03:00-03:59	10.2	2.9	96.2	0.1	6.8	0.4	0.8
04:00-04:59	10.2	2.8	95.7	0.1	6.8	0.3	0.9
05:00-05:59	10.2	2.8	94.7	0.1	6.8	0.3	0.9
06:00-06:59	10.3	2.9	94.2	0.1	6.7	0.4	0.9
07:00-07:59	10.3	2.9	93.2	0.1	6.7	0.3	1.0
08:00-08:59	10.4	3.4	91.5	0.2	6.6	7.7	1.1
09:00-09:59	13.6	10.5	75.2	10.1	2.7	2.4	10.5
10:00-10:29	19.6	4.6	0.2	1.1	0.2	0.7	1.0

TEST RUN 15
600°F/12 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/22/89
Test #: 15

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
08:49-08:59	19.9	3.5	<0.1	<0.1	0.2	<0.1	<0.1
09:00-09:59	15.6	8.0	40.2	6.0	1.1	0.9	9.6
10:00-10:54	14.2	9.4	75.5	3.7	1.3	12.3	12.1
11:13-11:59	17.9	20.0	7.9	1.0	1.2	0.7	2.4
12:00-12:59	17.6	20.8	9.0	0.9	1.3	0.9	1.8
13:00-13:59	17.6	20.6	9.1	0.8	1.3	0.8	1.6
14:00-14:59	17.6	20.5	9.0	0.8	1.3	0.6	1.6
15:00-15:59	17.3	21.7	10.3	1.1	1.4	0.9	1.6
16:00-16:59	17.0	23.3	12.1	1.6	1.7	0.6	1.7
17:00-17:59	16.3	24.9	14.2	1.9	2.1	0.5	1.8
18:00-18:59	15.4	22.6	19.7	0.9	2.8	0.5	1.6
19:00-19:59	14.5	15.6	31.2	0.1	3.5	0.6	1.2
20:00-20:59	13.4	10.5	44.9	<0.1	4.2	0.6	1.1
21:00-21:59	12.2	5.8	65.5	<0.1	5.1	0.5	1.2
22:00-22:59	10.8	3.7	88.9	<0.1	6.1	0.5	1.2
23:00-23:59	9.6	3.0	75.9	<0.1	6.9	18.7	20.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/23/89
Test #: 15

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	8.8	3.0	56.9	<0.1	7.5	45.0	39.7
01:00-01:59	7.6	3.0	73.3	<0.1	8.4	50.9	43.0
02:00-02:59	7.1	3.0	95.1	<0.1	8.7	54.5	59.1
03:00-03:59	6.8	2.8	82.9	<0.1	8.9	54.4	41.1
04:00-04:59	6.1	3.0	64.0	<0.1	9.4	49.3	32.3
05:00-05:59	6.2	3.2	62.4	<0.1	9.3	37.1	22.2
06:00-06:59	6.7	3.1	63.1	<0.1	9.1	42.1	23.1
07:00-07:59	6.6	3.2	63.3	<0.1	9.1	42.3	23.1
08:00-08:59	6.7	3.1	62.5	<0.1	9.0	39.5	21.5
09:00-09:59	8.1	8.5	90.5	8.9	5.4	34.6	23.1
10:00-10:59	5.4	3.1	109.3	0.9	7.1	36.1	18.6
11:00-11:59	7.0	3.1	56.0	0.3	8.8	34.8	18.7
12:00-12:59	7.5	3.0	57.4	0.3	8.5	32.2	15.7
13:00-13:59	6.9	3.2	58.7	0.5	8.9	34.7	17.0
14:00-14:59	7.1	3.2	57.5	0.4	8.8	34.1	15.7
15:00-15:59	7.0	3.0	58.7	0.4	8.8	34.8	17.1
16:00-16:59	6.9	2.8	58.4	0.3	8.9	37.7	16.7
17:00-17:59	6.8	2.7	58.0	0.3	8.9	39.0	17.8
18:00-18:59	6.8	2.6	57.8	0.3	9.0	40.3	17.6
19:00-19:24	6.8	2.6	56.3	0.4	9.0	46.3	17.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/24/89
Test #: 15

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
09:14-09:59	11.2	2.6	87.2	0.5	5.9	0.5	1.5
10:00-10:59	10.8	2.8	92.3	0.5	6.2	0.7	1.3
11:00-11:59	9.4	2.9	104.4	0.5	7.2	0.7	1.4
12:00-12:59	9.3	3.2	106.5	0.5	7.2	0.6	1.6
13:00-13:59	9.4	3.4	106.0	0.5	7.1	0.8	1.5
14:00-14:59	9.5	3.3	104.6	0.5	7.1	0.7	1.5
15:00-15:59	9.4	3.3	108.2	0.5	7.1	0.5	1.6
16:00-16:59	9.4	3.2	106.7	0.5	7.1	0.7	1.2
17:00-17:59	9.4	3.0	106.7	0.5	7.1	0.5	1.4
18:00-18:59	9.4	2.8	106.3	0.4	7.1	0.7	1.2
19:00-19:59	9.3	2.6	107.4	0.4	7.1	0.6	1.0
20:00-20:59	9.4	2.6	107.2	0.4	7.1	0.5	1.1
21:00-21:59	9.4	2.6	105.7	0.4	7.1	0.5	1.1
22:00-22:59	9.3	2.5	107.5	0.4	7.2	0.6	1.0
23:00-23:59	9.3	2.6	106.5	0.4	7.2	0.6	0.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/25/89
Test #: 15

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	9.3	2.6	107.4	0.4	7.2	0.5	1.0
01:00-01:59	9.4	2.7	105.8	0.4	7.1	0.5	1.1
02:00-02:59	9.4	2.5	104.5	0.4	7.1	0.5	0.9
03:00-03:59	9.3	2.5	105.2	0.4	7.2	0.5	0.9
04:00-04:59	9.4	2.4	103.7	0.4	7.1	0.4	1.0
05:00-05:59	9.4	2.4	103.3	0.4	7.1	0.4	0.9
06:00-06:59	9.4	2.5	102.3	0.4	7.1	0.5	0.9
07:00-07:59	9.5	2.5	99.4	0.4	7.0	0.5	0.9
08:00-08:59	10.2	3.1	87.4	3.4	6.2	6.9	8.0
09:00-09:59	8.0	9.7	190.5	1.9	2.5	0.7	2.1
10:00-10:59	10.7	3.0	98.9	0.6	6.3	0.6	1.3
11:00-11:59	10.7	3.0	99.5	0.5	6.2	0.5	1.4
12:00-12:59	10.7	3.1	99.4	0.5	6.2	0.6	1.3
13:00-13:59	10.7	3.2	100.0	0.5	6.2	0.5	1.2
14:00-14:59	10.7	3.2	100.2	0.5	6.2	0.4	1.4
15:00-15:59	10.3	3.0	100.5	0.5	6.4	0.5	1.3
16:00-16:59	9.6	3.0	105.5	0.5	6.9	0.4	1.3
17:00-17:59	9.5	3.0	105.2	0.5	6.9	0.5	1.2
18:00-18:59	9.5	2.9	103.6	0.5	7.0	0.5	1.1
19:00-19:59	9.5	2.7	101.4	0.4	7.0	0.4	1.1
20:00-20:59	9.4	2.6	103.0	0.4	7.1	0.5	0.9
21:00-21:59	9.5	2.6	102.5	0.4	7.0	0.4	1.0
22:00-22:59	9.5	2.7	104.3	0.4	7.0	0.4	1.0
23:00-23:59	9.5	2.6	103.3	0.4	7.0	0.3	1.0

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/26/89
Test #: 15

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	9.5	2.6	102.7	0.4	7.0	0.5	0.9
01:00-01:59	9.5	2.6	104.4	0.4	7.0	0.3	0.9
02:00-02:59	9.5	2.6	103.2	0.4	7.0	0.4	0.9
03:00-03:59	9.6	2.6	102.3	0.4	7.0	0.3	0.9
04:00-04:59	9.6	2.5	102.0	0.4	7.0	0.4	0.8
05:00-05:59	9.6	2.5	102.6	0.4	7.0	0.3	0.9
06:00-06:59	9.6	2.6	101.9	0.4	6.9	0.4	0.8
07:00-07:59	9.5	6.6	106.6	3.6	5.9	4.7	9.3
08:00-08:59	9.9	3.0	96.5	0.5	6.8	0.4	1.3
09:00-09:59	9.9	3.1	94.4	0.5	6.8	0.5	1.4
10:00-10:59	9.9	3.2	97.0	0.5	6.8	0.5	1.5
11:00-11:59	9.9	3.2	98.6	0.5	6.8	0.6	1.5
12:00-12:59	9.9	3.2	99.4	0.5	6.8	0.5	1.5
13:00-13:59	9.9	3.3	100.2	0.5	6.7	0.7	1.4
14:00-14:59	9.9	3.4	101.1	0.5	6.7	0.7	1.4
15:00-15:59	9.9	3.3	102.3	0.5	6.7	0.5	1.5
16:00-16:59	9.8	3.2	101.5	0.5	6.8	0.7	1.3
17:00-17:59	9.7	3.1	101.3	0.5	6.8	0.6	1.3
18:00-18:59	9.7	3.0	98.9	0.4	6.9	0.4	1.3
19:00-19:59	9.6	2.8	97.0	0.4	6.9	0.5	1.1
20:00-20:59	9.6	2.7	96.7	0.4	6.9	0.5	1.0
21:00-21:59	9.6	2.7	96.0	0.4	6.9	0.4	1.1
22:00-22:59	9.7	2.7	97.1	0.4	6.9	0.6	0.9
23:00-23:59	9.7	2.6	99.4	0.4	6.9	0.4	1.0

TEST RUN 16
600°F/6 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/27/89
Test #: 16

Test Time	Afterburner Outlet O_2 (%)	Afterburner Outlet CO (ppm)	Afterburner Outlet NO_x (ppm)	Afterburner Outlet THC (ppm)	Afterburner Outlet CO_2 (%)	Flash Chamber Inlet THC (ppm)	Flash Chamber Outlet THC (ppm)
00:00-00:59	9.7	2.6	96.6	0.4	6.9	0.5	0.9
01:00-01:59	9.7	2.7	95.4	0.4	6.9	0.4	1.0
02:00-02:59	9.7	2.7	96.9	0.4	6.9	0.4	1.0
03:00-03:59	9.7	2.7	97.2	0.4	6.9	0.4	1.0
04:00-04:59	9.7	2.6	97.2	0.4	6.9	0.5	0.9
05:00-05:59	9.8	2.8	96.1	0.4	6.9	0.3	0.9
06:00-06:59	9.8	2.5	95.6	0.4	6.9	0.3	1.0
07:00-07:59	11.4	2.8	79.4	0.6	5.7	3.9	3.0
08:00-08:59	11.4	13.1	81.3	9.6	2.1	6.5	41.2
09:00-09:54	9.7	8.3	145.1	3.8	1.0	7.9	9.3
10:35-10:59	18.5	16.5	3.8	3.2	0.8	1.0	5.7
11:00-11:59	17.8	22.4	7.7	2.4	1.3	1.1	3.9
12:00-12:59	17.8	22.3	8.1	2.3	1.3	1.1	2.6
13:00-13:59	17.8	21.4	8.1	1.9	1.3	1.0	2.1
14:00-14:59	17.7	22.0	8.8	1.8	1.4	0.9	2.1
15:00-15:59	17.4	22.8	9.9	1.9	1.6	1.2	1.9
16:00-16:59	16.7	24.9	12.5	2.4	2.0	1.0	1.9
17:00-17:59	15.9	24.2	15.6	1.8	2.6	0.9	1.9
18:00-18:59	15.2	19.7	22.4	1.1	3.1	1.1	1.7
19:00-19:59	14.3	12.5	33.1	0.6	3.8	1.0	1.8
20:00-20:59	12.9	8.2	52.8	0.3	4.9	1.0	1.7
21:00-21:59	11.4	3.3	76.8	0.3	5.9	1.1	1.7
22:00-22:05	10.7	2.8	86.8	0.2	6.5	<0.1	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/29/89
Test #: 16

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
08:27-08:59	10.1	3.5	11.2	<0.1	6.7	1.0	1.3
09:00-09:59	10.7	3.3	3.6	<0.1	6.3	0.4	1.2
10:00-10:59	10.8	3.3	0.6	<0.1	6.3	0.3	1.3
11:00-11:59	10.7	3.4	0.7	<0.1	6.3	0.5	1.2
12:00-12:59	10.8	3.5	0.5	<0.1	6.2	0.4	1.4
13:00-13:59	10.8	3.6	56.4	<0.1	6.2	0.4	1.3
14:00-14:59	10.8	4.1	8.2	<0.1	6.2	0.7	1.3
15:00-15:59	11.1	7.5	<0.1	1.7	5.9	5.0	10.6
16:00-16:59	10.9	3.6	50.0	<0.1	6.2	1.5	3.7
17:00-17:59	10.8	3.6	105.6	<0.1	6.2	0.9	1.8
18:00-18:59	10.8	3.3	104.1	<0.1	6.2	1.3	1.9
19:00-19:59	10.8	3.1	105.1	<0.1	6.2	0.5	1.4
20:00-20:59	10.8	3.2	103.3	<0.1	6.2	0.6	1.3
21:00-21:59	10.8	3.0	101.0	<0.1	6.2	0.5	1.2
22:00-22:59	10.7	3.1	103.9	<0.1	6.2	0.5	1.1
23:00-23:59	10.8	3.2	103.3	<0.1	6.2	0.5	0.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/30/89
Test #: 16

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.8	3.0	100.9	<0.1	6.2	0.3	0.9
01:00-01:59	10.8	2.8	101.8	<0.1	6.2	0.4	1.0
02:00-02:59	10.8	2.8	103.1	<0.1	6.2	0.5	0.9
03:00-03:59	10.8	2.8	103.0	<0.1	6.2	0.3	0.9
04:00-04:59	10.7	2.9	105.1	<0.1	6.3	0.2	0.8
05:00-05:59	10.7	2.9	104.8	<0.1	6.3	0.4	0.7
06:00-06:59	[illegible]	3.0	103.9	<0.1	6.2	0.2	0.9
07:00-07:59	10.7	2.9	103.7	<0.1	6.2	0.2	0.9
08:00-08:59	10.8	2.9	99.9	<0.1	6.2	0.3	0.7
09:00-09:25	15.0	3.3	52.3	0.1	3.2	0.6	0.7

TEST RUN 17
600°F/48 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/01/89
Test #: 17

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
10:20-10:59	19.3	2.9	0.4	8.0	0.2	0.7	11.9
11:00-11:59	18.9	8.5	1.9	6.8	0.4	0.7	10.3
12:00-12:59	17.8	22.3	8.8	5.9	1.2	1.0	7.0
13:00-13:59	17.6	22.8	9.4	4.3	1.3	0.7	6.9
14:00-14:59	17.7	22.4	9.2	3.7	1.3	1.0	5.8
15:00-15:59	17.6	25.2	9.7	5.0	1.4	0.7	11.5
16:00-16:59	17.2	28.3	12.3	7.5	1.6	1.0	12.4
17:00-17:59	16.6	30.7	15.2	5.2	2.0	0.6	8.5
18:00-18:59	15.8	30.8	18.9	2.8	2.6	0.9	6.2
19:00-19:59	15.1	24.3	24.2	1.2	3.1	0.8	4.9
20:00-20:59	14.0	14.6	38.2	0.3	3.9	0.5	3.8
21:00-21:59	12.9	6.8	56.8	<0.1	4.7	0.7	2.6
22:00-22:59	11.6	3.5	79.8	<0.1	5.7	0.6	2.2
23:00-23:59	10.9	3.0	71.2	<0.1	6.3	19.4	20.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/02/89
Test #: 17

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.9	2.6	48.1	<0.1	6.3	39.7	51.7
01:00-01:59	10.5	2.5	52.0	<0.1	6.5	44.2	39.7
02:00-02:59	10.1	2.4	53.7	<0.1	6.8	54.7	53.7
03:00-03:59	9.5	2.3	55.0	<0.1	7.4	50.4	47.6
04:00-04:59	7.9	2.4	54.6	<0.1	8.6	71.2	57.6
05:00-05:59	6.9	2.5	53.6	<0.1	9.3	66.0	58.5
06:00-06:59	6.1	2.5	54.6	<0.1	9.8	45.8	30.2
07:00-07:59	6.6	2.6	56.2	<0.1	9.5	40.2	26.1
08:00-08:59	6.2	3.1	57.9	<0.1	9.8	33.2	21.4
09:00-09:59	8.2	9.6	124.7	9.3	7.1	30.0	21.3
10:00-10:59	6.0	3.4	93.4	2.4	8.8	29.4	19.3
11:00-11:59	6.1	3.1	57.8	0.1	9.9	29.6	18.5
12:00-12:59	6.1	3.2	58.6	0.1	9.9	28.7	17.9
13:00-13:59	6.2	3.3	59.1	0.1	9.8	25.4	16.4
14:00-14:59	6.5	3.2	59.4	0.1	9.5	25.6	16.4
15:00-15:59	6.5	3.2	61.5	0.1	9.5	32.1	17.6
16:00-16:59	6.5	3.2	60.7	0.1	9.5	38.3	19.1
17:00-17:59	6.4	3.1	59.8	0.1	9.6	39.5	19.1
18:00-18:59	6.8	3.2	58.3	<0.1	9.3	45.5	19.7
19:00-19:59	7.1	2.7	56.9	<0.1	9.1	49.1	22.6
20:00-20:59	6.9	2.7	56.2	<0.1	9.3	48.9	21.3
21:00-21:59	7.0	2.7	56.6	<0.1	9.2	58.5	22.7
22:00-22:59	7.0	2.8	58.3	<0.1	9.2	54.1	22.4
23:00-23:59	6.9	2.8	57.9	<0.1	9.3	51.3	22.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/03/89
Test #: 17

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	6.9	2.9	59.1	<0.1	9.3	54.5	23.1
01:00-01:59	6.9	2.7	59.5	<0.1	9.3	54.5	23.3
02:00-02:59	6.8	2.6	59.2	<0.1	9.4	53.7	22.2
03:00-03:59	6.8	2.7	59.2	0.1	9.4	58.6	24.0
04:00-04:59	6.8	2.9	58.7	<0.1	9.4	53.9	25.2
05:00-05:59	6.6	2.7	58.1	0.1	9.5	55.4	21.6
06:00-06:59	6.6	2.6	57.8	0.1	9.6	55.3	24.1
07:00-07:59	6.7	2.8	58.7	<0.1	9.5	60.0	25.0
08:00-08:59	7.3	7.4	123.8	4.1	6.9	49.9	20.9
09:00-09:59	7.9	3.0	70.1	0.1	8.6	52.6	41.1
10:00-10:59	7.1	2.9	63.4	<0.1	9.3	54.1	43.3
11:00-11:59	6.9	3.1	63.3	0.1	9.3	53.5	39.7
12:00-12:59	7.3	3.1	63.6	0.1	9.1	52.4	38.5
13:00-13:59	7.3	3.1	64.5	0.1	9.1	49.9	33.7
14:00-14:59	7.3	3.2	65.1	0.1	9.0	48.2	34.8
15:00-15:59	7.4	3.2	64.9	0.1	9.0	47.3	32.4
16:00-16:59	7.4	3.1	64.6	0.1	9.0	45.8	31.5
17:00-17:59	7.3	3.1	64.8	0.1	9.0	47.2	34.3
18:00-18:59	7.3	2.9	62.5	<0.1	9.1	55.5	40.1
19:00-19:59	8.3	2.8	81.4	<0.1	8.3	40.5	31.5
20:00-20:59	7.2	2.7	60.3	<0.1	9.1	69.2	48.5
21:00-21:59	7.3	2.8	60.8	<0.1	9.1	69.7	50.4
22:00-22:59	8.2	2.8	76.3	<0.1	8.4	55.1	39.4
23:00-23:59	6.8	3.0	59.3	<0.1	9.4	68.9	39.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/04/89
Test #: 17

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	6.9	2.8	60.5	<0.1	9.4	69.8	46.3
01:00-01:59	6.8	2.6	60.4	<0.1	9.4	72.9	45.5
02:00-02:59	8.0	2.8	81.3	<0.1	8.5	64.7	29.9
03:00-03:59	7.4	2.6	60.1	<0.1	9.0	76.3	52.3
04:00-04:59	7.9	2.7	62.0	<0.1	8.7	82.4	61.5
05:00-05:59	8.1	2.8	62.4	<0.1	8.5	83.7	63.9
06:00-06:59	8.4	2.5	63.1	<0.1	8.4	85.2	65.0
07:00-07:59	10.0	2.6	78.2	0.1	7.2	53.4	52.0
08:00-08:59	7.4	3.2	62.0	<0.1	9.1	77.3	66.0
09:00-09:59	8.0	7.8	68.3	2.9	8.2	59.3	52.0
10:00-10:59	7.6	3.3	64.5	0.2	8.9	63.6	53.1
11:00-11:59	7.7	3.3	65.6	0.2	8.8	61.1	50.5
12:00-12:59	7.7	3.3	65.8	0.2	8.8	58.7	47.6
13:00-13:59	7.7	3.4	67.2	0.2	8.8	56.1	44.8
14:00-14:59	7.7	3.5	66.9	0.2	8.8	54.1	43.5
15:00-15:59	7.6	3.6	66.6	0.3	8.8	53.3	42.8
16:00-16:59	7.6	3.5	66.6	0.2	8.8	52.5	41.0
17:00-17:59	7.6	3.4	66.5	0.2	8.9	53.7	41.6
18:00-18:59	7.5	3.2	66.1	0.2	8.9	54.5	43.4
19:00-19:59	7.4	3.0	62.0	0.1	9.0	67.0	58.1
20:00-20:59	8.1	2.9	73.0	<0.1	8.5	71.1	37.3
21:00-21:59	11.8	3.0	103.4	0.1	5.8	1.3	2.9
22:00-22:59	12.0	2.7	101.9	0.2	5.6	0.9	1.9
23:00-23:59	12.0	3.0	96.4	0.1	5.6	0.9	1.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/05/89
Test #: 17

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.0	2.9	96.9	0.2	5.6	0.8	1.8
01:00-01:59	12.2	2.9	92.2	0.2	5.5	0.8	1.7
02:00-02:59	12.4	2.6	84.5	0.2	5.3	0.8	1.4
03:00-03:59	12.6	2.5	79.0	0.2	5.1	0.7	1.5
04:00-04:59	12.8	2.8	74.5	0.2	5.0	0.7	1.4
05:00-05:59	13.0	2.6	69.6	0.2	4.9	0.6	1.5
06:00-06:59	13.2	2.7	64.5	0.1	4.7	0.6	1.4
07:00-07:59	13.3	2.9	62.0	0.2	4.6	0.8	1.3
08:00-08:59	11.8	3.2	87.7	0.2	5.7	0.7	1.4
09:00-09:59	9.8	4.3	109.5	2.8	6.7	4.9	7.2
10:00-10:59	10.5	7.1	130.6	5.7	6.1	1.1	2.7
11:00-11:59	9.5	3.4	122.6	0.3	7.5	0.9	2.0
12:00-12:59	9.6	3.4	123.7	0.3	7.4	1.0	1.8
13:00-13:59	9.6	3.5	122.3	0.3	7.4	0.9	1.9
14:00-14:59	9.6	3.6	124.3	0.3	7.4	0.9	2.0
15:00-15:59	9.6	3.7	125.7	0.3	7.4	1.0	2.1
16:00-16:59	9.6	3.6	125.0	0.3	7.3	1.2	1.8
17:00-17:59	9.6	3.6	124.9	0.3	7.4	1.1	1.6
18:00-18:59	9.6	3.7	125.9	0.3	7.4	0.8	1.9
19:00-19:59	9.6	3.0	119.3	0.2	7.3	0.9	1.5
20:00-20:59	9.5	2.7	120.4	0.1	7.4	0.7	1.4
21:00-21:59	9.6	2.9	122.0	0.1	7.3	0.8	1.3
22:00-22:59	9.6	2.9	120.9	0.1	7.3	0.6	1.4
23:00-23:59	9.6	2.8	119.5	<0.1	7.3	0.6	1.3

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/06/89
Test #: 17

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	9.6	2.9	117.2	<0.1	7.3	0.7	1.2
01:00-01:42	9.7	2.8	114.1	<0.1	7.2	0.6	1.5
20:09-20:59	9.8	3.0	127.8	0.2	6.9	1.4	1.3
21:00-21:59	10.0	2.7	112.6	<0.1	6.9	0.5	1.1
22:00-22:59	10.1	2.5	111.0	<0.1	6.9	0.6	0.9
23:00-23:11	10.1	2.4	109.4	0.2	6.8	<0.1	0.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/08/89
Test #: 17

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
10:25-23:11	19.5	3.2	<0.1	<0.1	0.2	<0.1	<0.1

TEST RUN 18
500°F/6 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/13/89
Test #: 18

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
08:50-08:59	17.4	13.5	22.5	<0.1	0.6	<0.1	<0.1
09:00-09:59	11.9	31.6	0.5	<0.1	6.6	<0.1	<0.1
10:00-10:59	11.7	18.2	162.8	<0.1	2.5	<0.1	<0.1
11:00-11:59	17.3	27.1	8.8	<0.1	1.2	2.1	15.3
12:00-12:59	13.3	24.5	49.7	<0.1	2.8	8.4	10.7
13:00-13:59	17.2	27.7	10.5	10.0	1.5	15.9	5.7
14:00-14:59	16.4	34.2	14.0	1.8	2.0	1.9	1.9
15:00-15:59	13.1	29.9	8.7	3.6	3.4	11.3	5.0
16:00-16:59	15.8	8.3	59.8	1.1	0.9	30.9	18.3
17:00-17:59	17.8	5.9	11.7	4.4	0.5	0.9	1.9
18:00-18:59	18.8	5.4	4.2	0.4	0.5	0.9	1.5
19:00-19:59	18.6	4.3	6.0	0.3	0.6	0.9	1.5
20:00-20:59	18.5	5.9	7.1	0.3	0.7	20.4	4.3
21:00-21:59	13.6	8.8	5.3	0.5	0.7	29.8	13.9
22:00-22:59	12.9	5.3	61.9	0.3	4.9	6.1	9.4
23:00-23:59	11.0	6.2	61.6	0.2	6.3	24.4	24.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/14/89
Test #: 18

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	17.7	7.3	15.4	20.4	1.2	0.9	1.4
01:00-01:59	10.2	8.7	101.5	0.4	6.9	19.2	2.9
02:00-02:59	9.8	5.3	127.0	0.1	7.2	1.4	1.1
03:00-03:59	9.9	5.1	124.7	0.1	7.2	0.8	1.0
04:00-04:59	9.9	5.5	123.9	0.1	7.2	0.8	1.0
05:00-05:59	9.9	5.5	124.0	0.1	7.2	0.8	0.9
06:00-06:59	9.9	5.1	121.7	0.1	7.1	0.[illegible]	1.0
07:00-07:59	9.9	5.7	123.2	0.1	7.2	0.7	1.0
08:00-08:59	9.6	6.4	116.4	0.1	7.4	10.7	7.7
09:00-09:59	9.8	6.5	124.9	0.2	7.2	10.1	2.6
10:00-10:59	10.5	6.6	65.3	0.2	6.7	17.6	16.3
11:00-11:59	11.1	7.6	51.6	0.2	6.2	26.2	23.9
12:00-12:59	11.1	7.1	55.1	0.2	6.2	20.8	23.3
13:00-13:59	10.1	7.0	56.7	0.2	7.0	26.1	24.4
14:00-14:59	8.4	11.9	110.3	3.4	6.2	31.7	32.0
15:00-15:59	7.6	8.5	224.8	0.2	9.0	39.2	74.3
16:00-16:59	7.2	6.6	64.0	0.1	9.2	30.2	28.9
17:00-17:59	7.0	6.7	64.9	0.1	9.3	29.2	26.3
18:00-18:59	6.7	6.7	64.0	0.1	9.6	32.7	26.9
19:00-19:59	6.3	6.8	63.2	<0.1	9.8	35.5	27.6
20:00-20:59	6.2	7.1	64.6	<0.1	9.9	36.5	25.8
21:00-21:59	7.2	6.8	72.4	0.1	9.2	32.1	26.4
22:00-22:59	7.2	6.4	71.3	<0.1	9.2	31.9	27.0
23:00-23:59	7.2	6.3	71.5	<0.1	9.2	32.1	27.1

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 05/15/89
Test #: 18

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	7.2	6.4	70.9	<0.1	9.3	33.1	27.8
01:00-01:59	7.4	6.5	76.9	<0.1	9.1	32.9	24.0
02:00-02:59	11.7	5.3	116.8	<0.1	5.9	1.2	4.0
03:00-03:59	12.1	5.2	93.1	<0.1	5.5	1.1	3.1
04:00-04:59	12.4	5.1	81.0	<0.1	5.3	0.9	3.0
05:00-05:59	12.5	5.2	75.9	<0.1	5.2	0.9	4.6
06:00-06:59	12.6	5.2	72.1	<0.1	5.1	1.0	5.2
07:00-07:59	12.7	5.3	68.8	<0.1	5.1	0.9	3.6
08:00-08:59	11.7	11.5	100.0	2.8	4.5	6.6	9.2
09:00-09:59	11.5	5.5	121.4	0.3	4.7	0.9	1.7
10:00-10:59	9.7	6.0	112.8	0.2	7.4	1.0	1.7
11:00-11:59	9.8	6.0	115.5	0.2	7.3	0.8	1.9
12:00-12:59	9.8	6.1	115.9	0.2	7.3	0.8	1.8
13:00-13:59	9.8	5.8	115.2	0.2	7.2	0.9	1.6
14:00-14:59	9.9	5.8	112.2	0.2	7.2	0.7	1.7
15:00-15:59	9.9	6.0	111.9	0.2	7.1	0.9	1.6
16:00-16:59	9.9	6.6	109.8	0.2	7.1	0.7	1.9
17:00-17:59	9.9	6.4	111.4	0.2	7.1	0.7	1.7
18:00-18:59	9.8	5.8	108.8	0.1	7.2	0.8	1.4
19:00-19:59	9.8	6.8	106.7	0.1	7.2	0.7	1.4
20:00-20:59	9.8	5.8	108.8	<0.1	7.2	0.6	1.4
21:00-21:59	9.9	5.9	108.1	<0.1	7.1	0.7	1.1
22:00-22:59	10.0	5.4	106.3	<0.1	7.1	0.6	1.2
23:00-23:59	10.0	5.3	104.5	<0.1	7.0	0.6	1.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/16/89
Test #: 18

Test Time	Afterburner Outlet O_2 (%)	Afterburner Outlet CO (ppm)	Afterburner Outlet NO_x (ppm)	Afterburner Outlet THC (ppm)	Afterburner Outlet CO_2 (%)	Flash Chamber Inlet THC (ppm)	Flash Chamber Outlet THC (ppm)
00:00-00:59	10.1	5.3	103.4	<0.1	7.0	0.6	1.2
01:00-01:59	10.1	5.3	102.2	<0.1	7.0	0.5	1.2
02:00-02:59	10.1	5.1	99.5	<0.1	7.0	0.7	1.0
03:00-03:59	10.2	5.1	99.1	<0.1	6.9	0.6	1.0
04:00-04:59	10.2	5.3	97.4	<0.1	6.9	0.6	1.0
05:00-05:59	10.2	5.3	96.0	<0.1	6.9	0.5	0.9
06:00-06:59	10.2	5.8	95.0	<0.1	6.9	0.5	1.0
07:00-07:59	10.3	5.2	93.8	<0.1	6.8	0.5	1.0
08:00-08:59	11.1	8.9	89.3	7.2	3.6	29.1	16.5
09:00-09:59	10.5	5.9	92.7	5.0	6.7	6.8	10.9
10:00-10:59	10.5	6.2	92.8	0.2	6.6	1.0	1.7
11:00-11:59	10.6	5.9	93.3	0.2	6.6	0.8	2.0
12:00-12:59	10.6	5.9	92.5	0.2	6.6	0.8	1.6
13:00-13:59	10.6	5.6	94.5	0.2	6.6	0.9	1.6
14:00-14:59	10.5	5.3	95.0	<0.1	6.6	0.7	1.4
15:00-15:59	10.5	5.4	94.7	<0.1	6.6	0.7	1.4
16:00-16:59	10.4	5.3	94.9	<0.1	6.6	0.9	1.4
17:00-17:59	10.3	5.4	92.7	<0.1	6.7	1.3	1.7
18:00-18:59	10.3	5.7	91.4	<0.1	6.7	1.2	1.6
19:00-19:59	10.3	5.3	89.4	<0.1	6.7	1.0	1.3
20:00-20:59	10.3	5.7	87.6	<0.1	6.7	0.8	1.4
21:00-21:59	10.2	5.8	82.8	<0.1	6.8	0.7	1.3
22:00-22:59	10.2	5.1	76.1	<0.1	6.8	0.7	1.3
23:00-23:59	10.2	5.3	75.4	<0.1	6.8	0.8	1.1

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/17/89
Test #: 18

Test Time	Afterburner Outlet					Flash Chamber Inlet	Flash Chamber Outlet
	O_2 (%)	CO (ppm)	NO_x (ppm)	THC (ppm)	CO_2 (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.2	5.1	75.4	<0.1	6.8	0.7	1.2
01:00-01:59	10.1	4.9	75.0	<0.1	6.8	0.6	1.2
02:00-02:59	10.1	5.2	74.2	<0.1	6.8	0.6	1.1
03:00-03:59	10.1	4.8	73.2	<0.1	6.8	0.7	1.0
04:00-04:59	10.1	4.7	72.8	<0.1	6.8	0.7	1.0
05:00-05:59	14.7	5.0	38.9	0.4	3.5	0.6	1.0

APPENDIX F

RAW ANALYTICAL DATA SHEETS FOR TEST ITEMS

The following information is provided in Appendix F:

- Chain of custody forms (Custody Transfer Record/Lab Work Request).
- Data summaries from onsite analytical laboratory (WESTON Analytics-Explosives).
- Data summaries from offsite analytical laboratories.

Test data are presented for pre-test and post-test sampling events. The onsite laboratory conducted analyses for explosive compounds. The offsite analytical laboratory (WESTON Analytics Division, Lionville, PA) conducted the following analyses:

- Duplicate samples for explosive compounds (to verify analytical procedures of field laboratory).

- Samples collected from test items for smokeless powder.

- Samples collected from test items for ammonium picrate.

- Sample of gear oil from motor for explosives.

Analytical data summaries from the onsite laboratory provide the following information:

- Test Name (Pre-Test 2).
- Sample Matrix (wipe, rinsate, solid).
- Lab Identification Number.
- Sample Description.
- Dilution Factor.
- Sample Volume.
- Units of Reported Contamination.
- Reported Level of Contaminant.

Sample results for wipe samples are reported as total microgram (ug); rinsate samples are reported as microgram per milliliter (ug/mL); solid samples are reported as microgram per gram (ug/g). If the analysis indicated that the compound was present below the method detection limit, the detection limit is provided and is preceded with a less than sign (<).

The detection limits vary based on the sample type (wipe, rinsate or solid) and the dilution factor. For TNT, the following detection limits generally apply:

- Wipe samples - 19.2 mg.

- Rinsate samples - 0.96 mg/mL (concentrations corrected to 1,000 mL sample).

- Solid samples - 1.92 ug/g.

These detection limits are consistent with the limits outlined in the Test Plan (Section 5).

For the remaining analytes, however, some of the detection limits varied, due to high concentrations of TNT and required dilutions. The following example is provided for tetryl:

- The detection limit for tetryl in a rinsate sample was 2.5 ug/mL.

- Due to high concentrations of TNT in the rinsate sample, the sample is diluted by a factor of 1,000 to quantify the concentration of TNT.

- The detection limit of tetryl inadvertently increased to 2,500 ug/mL (2.5 ug/mL x 1,000 mL).

The mass or concentration of some contaminants is reported as a "J Value" (i.e., 3.36J). This indicates that the compound was determined to be present but below the detection level. The mass of contaminant is estimated.

The offsite laboratory data summaries include:

- Inorganic narrative (explosives narrative presented, where applicable).

- Glossary of terms.

- Inorganics data summary report.

- Inorganics quality assurance/quality control (QA/QC) report.

The inorganic narrative is generally a summary of the quality control results and a description of any problems encountered during the analysis of the samples. The glossary of terms defines the data qualifiers used in the report, abbreviations, and a laboratory chronology and holdtime report.

The inorganics data summary presents the actual results of the analysis. In addition, the lab sample number, site ID, analyte tested, result in appropriate units, and the reporting limit are provided.

The inorganics QA/QC report includes the analysis of a method blank, inorganics accuracy report, and an inorganics duplicate spike report.

TEST RUN 2
400°F/24 HOURS

WESTON Analytics Use Only
8907HW006

Custody Transfer Record/Lab Work Request

WESTON

Client: USATHAMA/HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Nancy Johnson
Client Contact/Phone: Ta

		Refrigerator#									
		#/Type Container									
		Containers/Volume									
		Preservative									
		ANALYSES REQUESTED		Ex PL							
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected								
001	PB1 Flush 1L	liq	7/17/89	X							
002	PB2 Flush 1L	"									
003	SR1 Pre-wipe #1	wipe									
004	" #2										
005	" #3										
006	" #4										
007	" #5										
008	SR1 decon Pre-spike										
009	SR2 Pre-wipe #1										
010	" #2										
011	" #3										
012	" #4										
013	" #5										
014	SR2 decon Pre-spike										
015	Motor Pre-soak	liq									

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: Combine extracts from SR1 Pre-wipe 1/2/3/4/5 and analyze as one. Combine extracts from SR2 Pre-wipe 1/2/3/4/5 and analyze as one
27 4L solvent bottles used

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

RFW 21-21-001/A-5/88

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8901HW007

Client: USATHAMA / HIVAAP
Work Order: 2281-08-02
Date Rec'd: ______ Date Due: ______
RFW Contact: Nancy Johnson
Client Contact/Phone: I2

Refrigerator#				
#/Type Container				
Containers/Volume				
Preservative				
ANALYSES REQUESTED ➡			Ex1	

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Ex1
001	SR1 drum App1	W	7/19/89	X
002	SR2 drum App1	"	"	X

Matrix:
S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions:

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 9907HW0001007
Installation HAWTHORNE
Matrix: RINSATE & WIPE

Analytical Lot:
Date Prepared
Date Analyzed 7/17, 20/99

Units RINSATE - ug/mL WIPE - total ug
Analyst Sam Ios
Reviewed

Note: Data is corrected for dilution,

Comment: T2 PRE TEST

MATRIX	R	R	W	W	W	W	R	R	R		
LAB ID #	006-001	006-002	006-003-007	006-008	006-009-013	006-014	006-015	007-001	007-002		
SAMPLE DESCRIPTION	T2 PO1 FLUSH	T2 PO2 FLUSH	T2 SR1 PRE-WIPES	T2 SR1 decon	T2 SR2 PRE-WIPES	T2 SR2 decon	MOTOR PRE-SOAK	T2 SR1 decon soak	T2 SR2 decon soak		
Dilution	1	1	1	1	1	1	1	1000	100		
SAMPLE VOLUME (mLs)	1000	1000	-	-	-	-	108,000	21	56		
UNITS	ug/mL	ug/mL	total ug	total ug	total ug	total ug	ug/mL	ug/mL	ug/mL		
HMX	<0.635	<0.635	<12.7	<12.7	<12.7	<12.7	<0.635	<0.635	<0.635		
RDX	<0.490	<0.490	<9.80	<9.80	<9.80	<9.80	2.35	<0.490	<0.490		
1,3,5-TNB	<1.05	<1.05	<20.9	<20.9	<20.9	<20.9	<1.05	<1.05	<1.05		
1,3-DNB	<0.295	<0.295	<5.90	<5.90	<5.90	<5.90	<0.295	<0.295	<0.295		
NB	<0.210	<0.210	1.40*	9.70*	4.10*	6.60*	<0.210	<0.210	<0.210		
Tetryl	<2.50	<2.50	<50.0	<50.0	<50.0	<50.0	<2.50	<2.50	<2.50		
2,4,6-TNT	<0.960	<0.960	470	<19.2	<19.2	<19.2	1.01	6250	2520		
2,6-DNT	<0.200	<0.200	<4.00	<4.00	<4.00	<4.00	<0.200	<0.200	<0.200		
2,4-DNT	<0.210	<0.210	<4.20	<4.20	<4.20	<4.20	1.11	<0.210	<0.210		
QA/QC DATE (1999)	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/20	7/20		

3

WESTON

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
3907HW014

Client USATHAMA/ NWAMC
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact MAZelon, COSMOS, N. Blaun
Client Contact/Phone 215-430-3117

Refrigerator#				
#/Type Container			30ml	
Containers/Volume				
Preservative				
ANALYSES REQUESTED ➡			T2	

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	T2
014-001	T2 SHR R1	AQ	7/28	X
002	2			X
003	3			X
004	4			X
014-021	T2 SHR1 Nipple wipe	WIPE	7/28	X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T-2 POST TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/ Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8907HW014

Client Leathama / Hiu AAP
Work Order 2281-08-02
Date Rec'd. ____ Date Due ____
RFW Contact Mazelen, M. Johnson, Collins
Client Contact/Phone 215-430-3117

		Refrigerator#													
		#/Type Container		500 ml [illegible]		VOA									
		Containers/Volume													
		Preservative		Cool		Acid									
		ANALYSES REQUESTED ➡		Exp		Exp									
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected												
014-005	T2 SHV RINSE 1	AQ	7/28	X											
006	2	↓	↓	X											
007	3	↓	↓	X											
008	4	↓	↓	X											
009	FLASH CHMB WALL W1	WIPE	7/28			X									
010	STEEL PIPE W1 T2	WIPE	7/28			X									
011	T2 SM W1	WIPE	7/28			X									
012	T2 SSR 1 W1 TOP	WIPE	7/28			X									
013	2	↓	↓			X									
014	3	↓	↓			X									
015	4	↓	↓			X									

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: EXP - EXPLOSIVES
POST T-2 SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

2

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 9907HW014 1015

Client: USATHAMA/NWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: MAZelm, CosMic, N. Johnson
Client Contact/Phone: 215-430-2117

		Refrigerator#											
		#/Type Container		VoA	500 ml Amber								
		Containers/Volume											
		Preservative											
		ANALYSES REQUESTED ➡		Exp	Exp								
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected										
014-016	T2 SSR1 WIPE 1 Bottom	WIPE	7/28	X									
-017	2			X									
-018	3			X									
-019	4			X									
-020	T2 CPS1	Solid	7/28		X								
015-001	T2 PB1 R1				X								
002	2				X								
003	3				X								
004	4				X								
-005	T2 WIPE BLANK	WIPE		X									
006	T2 Beaker Rinsate	AQ			X								

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: EXP - EXPLOSIVES

T-2 POST TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-118

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907L014/015
Installation HAWTHORNE
Matrix: RINSATE WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 7/28/89

Units RINSATE - ug/ml WIPE - total ug Soil - ug/g
Analyst gam
Reviewed

Note: Data is corrected for dilution,

Comment: TA POST TEST

MATRIX	R	R	R	R	R	R	R	R	W	W	W
LAB ID #	014-001	014-002	014-003	014-004	014-005	014-006	014-007	014-008	014-009	014-010	014-011
SAMPLE DESCRIPTION	TA SHRI RINSE #1	TA SHRI RINSE #2	TA SHRI RINSE #3	TA SHRI RINSE #4	TA SHVI RINSE #1	TA SHVI RINSE #2	TA SHVI RINSE #3	TA SHVI RINSE #4	FLASH CHAMBER WALL	STEEL PIPE WIPE	SHIP MINE WIPE
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mls)	300	300	300	300	1000	1000	1000	1000	—	—	—
UNITS	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	total ug	total ug	total ug
HMX	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<12.7	<12.7	<12.7
RDX	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<9.80	<9.80	<9.80
1,3,5-TNB	<1.05	<1.05	0.940 J	0.505 J	<1.05	<1.05	<1.05	<1.05	<20.9	<20.9	<20.9
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<5.89	<5.89	<5.89
NB	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	19.9 *	34.1 *	21.6 *
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<50.0	<50.0	<50.0
2,4,6-TNT	<0.960	<0.960	<0.960	<0.960	1.34	2.68	3.36	2.18	<19.2	<19.2	<19.2
2,6-DNT	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<4.00	<4.00	<4.00
2,4-DNT	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<4.20	<4.20	<4.20
ANALYSIS DATE (1989)	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28

J - present below detection limit.

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 8907IW-014/015
Installation HAWTHORNE
Matrix: RINSATE WIPES & SOIL

Analytical Lot
Date Prepared
Date Analyzed 7/28/89

Units RINSATE-ug/ml WIPE-total ug SOIL-ug/g
Analyst gam
Reviewed

Notes Data is corrected for dilution,

Comment: T3 POST TEST

MATRIX	W	W	W	W	W	W	W	W	S	W	R
LAB ID #	014-012	014-013	014-014	014-015	014-016	014-017	014-018	014-019	014-020	014-021	015-001
SAMPLE DESCRIPTION	T3 SRI TOP WIPE #1	T3 SRI TOP WIPE #2	T3 SRI TOP WIPE #3	T3 SRI TOP WIPE #4	T3 SRI BOTTOM WIPE #1	T3 SRI BOTTOM WIPE #2	T3 SRI BOTTOM WIPE #3	T3 SRI BOTTOM WIPE #4	T3 CP SOIL	T3 SRI NIPPLE WIPE	T3 PBI RINSE #1
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mls)	–	–	–	–	–	–	–	–	–	–	1000
UNITS	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	ug/g	total ug	ug/ml
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<1.27	<12.7	<0.635
RDX	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<0.980	<9.80	<0.490
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<2.09	<20.9	<1.05
1,3-DNB	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<0.589	<5.89	<0.295
NB	13.3*	8.4*	17.8*	15.1*	9.93*	20.1*	17.9*	15.9*	<0.419	8.31*	<0.210
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<5.0	<50.0	<50.0
2,4,6-TNT	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<1.92	<19.2	<0.960
2,6-DNT	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<0.400	<4.00	<0.200
2,4-DNT	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<0.420	<4.20	<0.210
CAL/QC DATE (1989)	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907H...015
Installation Hawthorne
Matrix: Rinsate, Wipe & Soil

Analytical Lot
Date Prepared
Date Analyzed 7/20/89

Units Rinsate - ug/L Wipes - total ug Soil - ug/g
Analyst GAM
Reviewed

Note: Data is corrected for dilution.

Comment: T2 POST TEST

MATRIX	R	R	R	W	R						
LAB ID #	015-002	015-003	015-004	015-005	015-006						
SAMPLE DESCRIPTION	T2 P01 RINSE # 2	T2 P01 RINSE # 3	T2 P01 RINSE # 4	WIPE FIELD BLANK	RINSATE FIELD BLANK						
Dilution											
SAMPLE VOLUME (mLs)	1000	1000	1000	-	19						
UNITS	ug/mL	ug/mL	ug/mL	total ug	ug/mL						
HMX	<0.635	<0.635	<0.635	<12.7	<0.635						
RDX	<0.490	<0.490	<0.490	<9.80	<0.490						
1,3,5-TNB	<1.05	<1.05	<1.05	<20.9	<1.05						
1,3-DNB	<0.295	<0.295	<0.295	<5.09	<0.295						
NB	<0.210	<0.210	<0.210	5.22*	<0.210						
Tetryl	<2.5	<2.5	<2.5	<50.0	<2.5						
2,4,6-TNT	<0.960	<0.960	<0.960	<19.2	<0.960						
2,6-DNT	<0.200	<0.200	<0.200	<4.00	<0.200						
2,4-DNT	<0.210	<0.210	<0.210	<4.20	<0.210						
QA/QC DATE (Level)	7/26	7/26	7/26	7/26	7/26						

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/21/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
-001	POST T5-FLSH CHMB WA	NITRATED ESTERS	5.0	u	UG	5
-002	POST T2-SHIP MINE	NITRATED ESTERS	5.0	u	UG	5
-003	PRE T5-SHIP MINE	NITRATED ESTERS	5.0	u	UG	5
-005	PRE T5-BLANK WIPE	NITRATED ESTERS	5.0	u	UG	5

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L203

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L2(

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99
		NITRATED ESTERS	49.5	2.5 u	50.0	99

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE

WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L203

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

TEST RUN 3
500°F/36 HOURS

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8907HW002

Client: USATHAMA
Work Order: 2281-08-02
Date Rec'd: 7/14/89 Date Due:
RFW Contact: Nancy Johnson
Client Contact/Phone:

Refrigerator#	
#/Type Container	
Containers/volume	
Preservative	
ANALYSES REQUESTED	[illegible]

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected									
001	T3 SR1 Pre-wire #1	wire	7/14/89									
002	T3 SR1 Pre-wire #2	wire										
003	T3 SR1 Pre-wire #3	wire										
004	T3 SR1 Pre-wire #4	wire										
005	T3 SR1 Pre-wire #5	wire										
006	T3 SR1 decon pre-spike	wire										
007	T3 SR2 Pre-wire #1											
008	T3 SR2 Pre-wire #2											
009	T3 SR2 Pre-wire #3											
010	T3 SR2 Pre-wire #4											
011	T3 SR2 Pre-wire #5											
012	T3 SR2 decon pre-spike											
013	T3 PB1 Flush	liquid										
014	T3 PB2 Flush											
~~015~~ DF 7/15/89												

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions:

Page 1 of 2

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-118

Field lab

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8907HW002

Client: USATHAMA
Work Order: 2291-03-01
Date Rec'd.: 7/14/81
Date Due:
RFW Contact: [illegible]
Client Contact/Phone:

Refrigerator#	
#/Type Container	
Containers/Volume	
Preservative	
ANALYSES REQUESTED	Fe [illegible]

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected									
015	T3 SR1 [illegible] Appl	W	7/11/[illegible]									
016	T3 SR2 [illegible] Appl	W										
017	T3 SHR1 Flush #1											
018	T3 SHR2 Flush #1											
019	T3 SHR1 Flush #2											
020	T3 SHR2 Flush #2											
021	T3 SHR2 Flush #3											
022	T3 SHR1 Flush											
023	T3 SHR2 Flush											
024	T3 CP [illegible]	Sol			X							
025	T3 SM [illegible] #1	W										

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: Pag 2 OF 2

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

F[illegible] [illegible]

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8907HW004

Client: USATHAMA / HWAAP
Work Order: 2231-08-02
Date Rec'd.: 7/16 Date Due:
RFW Contact: Nancy Johnson
Client Contact/Phone:

			Refrigerator#	
			#/Type Container	
			Container/Volume	
			Preservative	
			ANALYSES REQUESTED ➡	Explosives
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	
001	T3 Chamb Wells Pre-Test Exp	Wipe	7/16/90	X

Matrix: S - Soil; SE - Sediment; SO - Solid; W - Water; O - Oil; A - Air; DS - Drum Solids; DL - Drum Liquids; F - Fish; X - Other

Special Instructions: T-3 PRE-TEST Field Lab samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

8907 HW 005

Client: USATHAMA [illegible]

Work Order: 2281-08-02- [illegible]

Date Rec'd. ______ Date Due ______

RFW Contact: Mike [illegible]

Client Contact/Phone ______

Refrigerator#	
#/Type Container	:A
Containers/Volume	1/
Preservative	Cool
ANALYSES REQUESTED →	NT

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	[illegible]
001	T3 PB PRETEST-WIPE	Wipe	7/15/87	✓

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T-3 PRE TEST

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907HW002/001/005/009/010 Analytical Lot ______ Units RINSATES-ug/L WIPES-total ug SOIL-ug
Installation HAWTHORNE Date Prepared ______ Analyst GARLOS
Matrix: RINSATE WIPES & SOIL Date Analyzed 7/16,17,20,21,24/89 Reviewed ______

Note: Data is corrected for dilution.

Comment: TEST 3 - PRE TEST

MATRIX	W	W	W	W	W	W	W	W	W	W	W
LAB ID #	002-001	002-001	002-002	002-002	002-003	002-003	002-004	002-005	002-005	002-006	002-007
SAMPLE DESCRIPTION	T3 SR1 PRE #1	T3 SR1 PRE #1	T3 SR1 PRE #2	T3 SR1 PRE #2	T3 SR1 PRE #3	T3 SR1 PRE #3	T3 SR1 PRE #4	T3 SR1 PRE #5	T3 SR1 PRE #5	T3 SR1 decon	T3 SR2 PRE #1
Dilution	1	10	1	10	1	10	1	1	10	1	1
SAMPLE VOLUME (mls)	—	—	—	—	—	—	—	—	—	—	—
UNITS	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug
HMX		644	450		269		1181	266		21.4	513
RDX		658		720		493	311		585	25.6	
1,3,5-TNB	<20.9		<20.9		<20.9		<20.9	<20.9		<20.9	<20.9
1,3-DNB	<5.90		<5.90		<5.90		<5.90	<5.90		<5.90	<5.90
NB	5.60*		5.10*		<4.20		<4.20	<4.20		<4.20	7.20*
Tetryl	<50.0		<50.0		<50.0		<50.0	<50.0		<50.0	<50.0
2,4,6-TNT	<19.2		<19.2		24.4		<19.2	49.1		<19.2	<19.2
2,6-DNT	<4.00		<4.00		<4.00		<4.00	<4.00		<4.00	<4.00
2,4-DNT	<4.20		<4.20		<4.20		<4.20	<4.20		<4.20	<4.20
QA/QC DATE (1989)	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17

* POSSIBLE CONTAMINATE

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907HW002/004/005/009/010 Analytical Lot ______
Installation HAWTHORNE Date Prepared ______
Matrix: RINSATE, WIPE & SOIL Date Analyzed 7/16,17,21,24/89 20

Units RINSATES-ug/L WIPES-total ug SOIL-ug/g
Analyst [illegible]
Reviewed ______

Note: Data is corrected for dilution,

Comment: TEST 3 - PRE TEST

MATRIX	W	W	W	W	W	W	R	R	R	R	R
LAB ID #	002-007	002-008	002-009	002-010	002-011	002-012	002-013	002-014	002-015	002-016	002-017
SAMPLE DESCRIPTION	T3 SR2 PRE #1	T3 SR2 PRE #2	T3 SR2 PRE #3	T3 SR2 PRE #4	T3 SFA PRE #5	T3 SR2 decon	T3 PB1 FLUSH	T3 PB2 FLUSH	T3 SR1 decon [illegible]	T3 SR2 decon [illegible]	T3 SHV1 FLUSH #1
Dilution	10	1	1	1	1	1	1	1	1000	1000	1
SAMPLE VOLUME (mls)	—	—	—	—	—	—	1000	1000	30	26	1000
UNITS	total ug	total ug	total ug	total ug	total ug	total ug	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL
HMX		305	221	157	149	25.6	<0.635	<0.635	<635	<635	1.43
RDX	673	457	418	327	294	76.2	<0.490	<0.490	<490	<490	<0.490
1,3,5-TNB		<20.9	<20.9	<20.9	<20.9	<20.9	<1.05	<1.05	<1050	<1050	<1.05
1,3-DNB		<5.90	<5.90	<5.90	<5.90	<5.90	<0.295	<0.295	<295	<295	<0.295
NB		<4.20	<4.20	<4.20	<4.20	10.0*	<0.210	<0.210	<210	<210	<0.210
Tetryl		<50.0	<50.0	<50.0	<50.0	<50.0	<2.5	<2.5	<2500	<2500	<2.5
2,4,6-TNT		<19.2	<19.2	<19.2	<19.2	<19.2	<0.960	<0.960	5500	5150	<0.960
2,6-DNT		<4.00	<4.00	<4.00	<4.00	<4.00	<0.200	<0.200	<200	<200	<0.200
2,4-DNT		<4.20	<4.20	<4.20	<4.20	<4.20	<0.210	<0.210	<210	<210	
QA/QC DATE (1989)	7/17	7/17	7/17	7/17	7/17	7/17	7/16	7/16	7/20	7/20	7/16

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907HW002/004/005/009/010 Analytical Lot ____________
Installation HAWTHORNE Date Prepared ____________
Matrix: RINSATE, WIPE & SOIL Date Analyzed 7/16,17,20,21,24/89

Units RINSATE - ug/L WIPE - total ug SOIL - ug/g
Analyst QAK/JDS
Reviewed ____________

Note: Data is corrected for dilution,

Comment: TEST 3 - PRE TEST

MATRIX	R	R	R	R	R	R	R	R	S	W	W
LAB ID #	002-017	002-018	002-018	002-019	002-020	002-021	002-022	002-023	002-024	002-025	004-001
SAMPLE DESCRIPTION	T3 SHV1 FLUSH #1	T3 SHV2 FLUSH #1	T3 SHV2 FLUSH #1	T3 SHV1 FLUSH #2	T3 SHV2 FLUSH #2	T3 SHV2 FLUSH #3	T3 SHR1 FLUSH	T3 SHR2 FLUSH	T3 CP PRE SOLID	T3 SM PRE #1	T3 CW PRE TEST
Dilution	10	1	10	1	1	1	1	1	10,000	1	1
SAMPLE VOLUME (mls)	1000	1000	1000	1000	1000	1000	300	300	–	--	–
UNITS	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	Total ug	Total ug
HMX		<0.635		<0.635	<0.635	<0.635	<0.635	<0.635	<12700	<12.7	<12.7
RDX		<0.490		<0.490	<0.490	<0.490	1.19	0.785	<9800	<9.80	<9.80
1,3,5-TNB		<1.05		<1.05	<1.05	<1.05	<1.05	<1.05	20900 <42000	<20.9	<20.9
1,3-DNB		<0.295		<0.295	<0.295	<0.295	<0.295	<0.295	<5900	<5.90	<5.90
NB		<0.210		<0.210	<0.210	<0.210	<0.210	<0.210	4200 <20400	8.60*	18.1*
Tetryl		<2.50		<2.50	<2.50	<2.50	<2.50	<2.50	<50000	<50.0	<50.0
2,4,6-TNT		<0.960		<0.960	<0.960	<0.960	<0.960	<0.960	153000	<19.2	<19.2
2,6-DNT		<0.200		<0.200	<0.200	<0.200	<0.200	<0.200	<4000	<4.00	<4.00
2,4-DNT	41.5		23.5	16.8	9.1	1.7	<0.210	<0.210	<4200	<4.20	<4.20
QA/QC DATE (1989)	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/21	7/17	7/17

* POSSIBLE CONTAMINATE

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907H002/004/005/009/010 Analytical Lot ______
Installation HAWTHORNE Date Prepared ______
Matrix: RINSATE WIPE & SOIL Date Analyzed 7/11,17,22,21,24/89

Units RINSATE-ug/L WIPES-total ug SOIL-ug/g
Analyst [illegible]
Reviewed ______

Note: Data is corrected for dilution,

Comment: TEST 3 - POST TEST EXCEPT FOR 005-001

MATRIX	W	R	R	R	R	W	R	R	R	R	R
LAB ID #	005-001	009-001	009-002	009-003	009-004	009-005	009-006	009-007	009-008	009-009	010-001
SAMPLE DESCRIPTION	T3 PB PRE	T3 PB1 RINSE #1	T3 PB1 RINSE #2	T3 PB1 RINSE #3	T3 PB1 RINSE #4	T3 PB W1	T3 SHR1 RINSE #1	T3 SHR1 RINSE #2	T3 SHR1 RINSE #3	T3 SHR1 RINSE #4	T3 SHV1 RINSE #1
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mLs)	—	1000	1000	1000	1000	—	300	300	300	300	1000
UNITS	total ug	ug/mL	ug/mL	ug/mL	ug/mL	total ug	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL
HMX	<12.7	<0.635	<0.635	<0.635	<0.635	<12.7	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<9.80	<0.490	<0.490	<0.490	<0.490	<9.80	<0.490	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB	<20.9	<1.05	<1.05	<1.05	<1.05	<20.9	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<5.90	<0.295	<0.295	<0.295	<0.295	<5.90	<0.295	<0.295	<0.295	<0.295	<0.295
NB	8.60*	<0.210	<0.210	<0.210	<0.210	20.5*	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl	<50.0	<2.50	<2.50	<2.50	<2.50	<50.0	<2.50	<2.50	<2.50	<2.50	<2.50
2,4,6-TNT	<19.2	<0.960	<0.960	<0.960	<0.960	<19.2	<0.960	<0.960	<0.960	2.43	<0.960
2,6-DNT	<4.00	<0.200	<0.200	<0.200	<0.200	<4.00	<0.200	<0.200	<0.200	<0.200	<0.200
2,4-DNT	<4.20	<0.210	<0.210	<0.210	<0.210	<4.20	<0.210	<0.210	<0.210	<0.210	<0.210
QA/QC DATE (1989)	7/17	7/21	7/24	7/24	7/24	7/21	7/21	7/24	7/24	7/24	7/21

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8907HW009

Client: USATHAMA [illegible]
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: MIKE MARZIN / NANCY JOHNSON
Client Contact/Phone ______

Refrigerator#					
#/Type Container				Semi Anal	VOA
Containers/Volume				4	1
Preservative				Cool	
ANALYSES REQUESTED ➡				[illegible]	
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**		
001	T3 PB1 R1	AQ	7/21/89	X	
002	T3 PB1 R2			X	
003	T3 PB1 R3			X	
004	T3 PB1 R4			X	
005	T3 PB W1			X	X
006	T3 SHR1 R1			X	
007	T3 SHR1 R2			X	
008	T3 SHR1 R3			X	
009	T3 SHR1 R4			X	

Matrix:
S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T-3 POST TEST SAMPLING

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:
2 Ambient or Chilled
NOTES:
3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:
4 Properly Preserved Y N
NOTES:
5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

8907HW010

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ________ Date Due ________
RFW Contact MIKE MAZELON / NANCY ROBSON
Client Contact/Phone ________

Refrigerator#												
#/Type Container						1LA						
Containers/Volume				500ml Amber	500ml Amber							
Preservative				Cool	Cool	Cool						
ANALYSES REQUESTED				Explosives	Explosives	Explosives						
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**									
001	T3 SHV1 R1	AQ	7/21/89	X								
002	T3 SHV1 R2			X								
003	T3 SHV1 R3			X								
004	T3 SHV1 R4			X								
005	T3 CPS1	S	7/21/89		X							
006	T3 SM W1	W				X						
007	T3 SR1 W1	W				X						
008	T3 SR1 W2					X						
009	T3 SR1 W3					X						
010	T3 SR1 W4					X						
011	T3 SR1 W5					X						
012	T3 SR1 W6					X						
013	T3 SR1 W7					X						
014	T3 SR1 W8		7/21/89			X						

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T-3 POST TEST SAMPLING

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907HUX005/009/010 Analytical Lot ______ Units RINSATE - ug/L WIPE - total ug SOIL - ug/g
Installation HAWTHORNE Date Prepared ______ Analyst Gamlos
Matrix: RINSATE WIPE & SOIL Date Analyzed Jul 17,20,21,24/89 Reviewed ______

Note: Data is corrected for dilution,

Comment: TEST 3 - POST TEST EXCEPT FOR 005-001

MATRIX	W	R	R	R	R	W	R	R	R	R	R
LAB ID #	005-001	009-001	009-002	009-003	009-004	009-005	009-006	009-007	009-008	009-009	010-001
SAMPLE DESCRIPTION	T3 PB PRE	T3 PB1 RINSE #1	T3 PB1 RINSE #2	T3 PB1 RINSE #3	T3 PB1 RINSE #4	T3 PB W1	T3 SHR1 RINSE #1	T3 SHR1 RINSE #2	T3 SHR1 RINSE #3	T3 SHR1 RINSE #4	T3 SHV1 RINSE #1
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mls)	—	1000	1000	1000	1000	—	300	300	300	300	1000
UNITS	total ug	ug/L	ug/L	ug/L	ug/L	total ug	ug/L	ug/L	ug/L	ug/L	ug/L
HMX	<12.7	<0.635	<0.635	<0.635	<0.635	<12.7	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<9.80	<0.490	<0.490	<0.490	<0.490	<9.80	<0.490	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB	<20.9	<1.05	<1.05	<1.05	<1.05	<20.9	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<5.90	<0.295	<0.295	<0.295	<0.295	<5.90	<0.295	<0.295	<0.295	<0.295	<0.295
NB	8.60*	<0.210	<0.210	<0.210	<0.210	20.5*	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl	<50.0	<2.50	<2.50	<2.50	<2.50	<50.0	<2.50	<2.50	<2.50	<2.50	<2.50
2,4,6-TNT	<19.2	<0.960	<0.960	<0.960	<0.960	<19.2	<0.960	<0.960	<0.960	2.43	<0.960
2,6-DNT	<4.00	<0.200	<0.200	<0.200	<0.200	<4.00	<0.200	<0.200	<0.200	<0.200	<0.200
2,4-DNT	<4.20	<0.210	<0.210	<0.210	<0.210	<4.20	<0.210	<0.210	<0.210	<0.210	<0.210
AN/QC DATE (LAB9)	7/17	7/21	7/24	7/24	7/24	7/21	7/21	7/24	7/24	7/24	7/21

* POSSIBLE CONTAMINATE

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 0274-002/004/005/009/010
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot ______
Date Prepared ______
Date Analyzed 7/16,17,20,21,24/89

Units RINSATE-ug/L WIPE-total ug SOIL-ug/g
Analyst Ogan
Reviewed ______

Note: Data is corrected for dilution.

Comment: TEST 3 POST TEST

MATRIX	R	R	R	S	W	W	W	W	W	W	W
LAB ID #	010-002	010-003	010-004	010-005	010-006	010-007	010-008	010-009	010-010	010-011	010-012
SAMPLE DESCRIPTION	T3 SHVI RINSE #2	T3 SHVI RINSE#3	T3 SHVI RINSE #4	T3 CP S1	T3 3M W1	T3 SR1 W1	T3 SR1 W2	T3 SR1 W3	T3 SR1 W4	T3 SR1 W5	T3 SR1 W6
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mLs)	1000	1000	1000	–	–	–	–	–	–	–	–
UNITS	ug/mL	ug/mL	ug/mL	ug/g	total ug	total ug	total ug	total ug	total ug	total ug	total ug
HMX	<0.635	<0.635	<0.635	<1.27	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<0.490	<0.490	<0.490	<0.980	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80
1,3,5-TNB	<1.05	<1.05	<1.05	<2.09	<20.9	<20.9	<20.9	<20.9	<20.9	<2.09	<20.9
1,3-DNB	<0.295	<0.295	<0.295	<0.590	<5.90	<5.90 [illegible] *	<5.90	<5.90	<5.90	<5.90	<5.90
NB	<0.210	<0.210	<0.210	<0.42	16.3 *	10.7 *	9.67 *	8.59 *	8.83 *	12.0 *	14.7 *
Tetryl	<2.50	<2.50	<2.50	<5.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<0.960	<0.960	<0.960	<1.92	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<0.200	<0.200	<0.200	<0.400	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00
2,4-DNT	<0.210	<0.210	<0.210	<0.420	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
ANALYSIS DATE (HPLC)	7/24	7/24	7/24	7/24	7/21	7/21	7/24	7/24	7/24	7/21	7/24

* POSSIBLE [illegible]

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907HW002/003/005/008/010
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot ______
Date Prepared ______
Date Analyzed 7/11/89, 12, 20, 21, 24/89

Units RINSATE - ug/L, WIPE - total ug, SOIL - ug/g
Analyst GAM
Reviewed ______

Note: Data is corrected for dilution,

Comment: TEST 3 POST TEST

MATRIX	W	W									
LAB ID #	010-013	010-014									
SAMPLE DESCRIPTION	T3 SR1 W7	T3 SR1 W9									
Dilution	1	1									
SAMPLE VOLUME (mls)	—	—									
UNITS	total ug	total ug									
HMX	<12.7	<12.7									
RDX	<9.80	<9.80									
1,3,5-TNB	<20.9	<20.9									
1,3-DNB	<5.90	<5.90									
NB	13.9 *	8.23 *									
Tetryl	<50.0	<50.0									
2,4,6-TNT	<19.2	<19.2									
2,6-DNT	<4.00	<4.00									
2,4-DNT	<4.20	<4.20									

* POSSIBLE CONTAMINATE

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907HL009
Installation HAWTHORNE
Matrix: RINSATE

Analytical Lot
Date Prepared
Date Analyzed 7/26/89

Units ug/mL
Analyst [illegible]
Reviewed

Note: Data is corrected for dilution,

Comment: T3 POST TEST

MATRIX LAB ID #	009-006BW	009-007BW	009-008BW	009-009BW	013-001	013-002	013-003	013-004	013-005	013-006	013-007
SAMPLE DESCRIPTION	T3 SHE1 RINSE#1	T3 SHE1 RINSE#2	T3 SHE1 RINSE#3	T3 SHE1 RINSE#4	T3 SHE2 RINSE#1	T3 SHE2 RINSE#2	T3 SHE2 RINSE#3	T3 SHE2 RINSE#4	T3 SHE2 RINSE#5	T3 SHE2 RINSE#6	T3 SHE1 RINSE#5
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mLs)	300	300	300	300	300	300	300	300	300	300	300
UNITS	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL
HMX	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
2,4,6-TNT	<0.960	<0.960	<0.960	8.00	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960
2,6-DNT	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
2,4-DNT	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
QA/QC DATE (rev)	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/26

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

R^W Batch		Analytical Lot		Units	ug/mL
Installation		Date Prepared		Analyst	Qua
Matrix:		Date Analyzed	7/26/89	Reviewed	

Note: Data is corrected for dilution,

Comment: T3 POST TEST

LAB ID #	013-008											
SAMPLE DESCRIPTION	TISSUE RINSE 06											
Dilution	1											
SAMPLE VOLUME (mLs)	300											
UNITS	ug/L											
HMX	<0.635											
RDX	< 0.490											
1,3,5-TNB	< 1.05											
1,3-DNB	< 0.295											
NB	< 0.210											
Tetryl	< 2.50											
2,4,6-TNT	< 0.960											
2,6-DNT	< 0.200											
2,4-DNT	< 0.210											

QA/QC DATE (USED) 7/26

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA HAWTHORNE SAMPLES RECEIVED: 07-19-89
RFW #: 8907L058
W.O.#: 2281-08-07

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of wipe samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Method holding time of seven days way exceeded for sample preparation. This holding time is applicable to soil samples. Although this holding time is exceeded, lab experience with the long term stability of explosives compounds provides an indication that the data obtained is quite likely to be representative of initial explosive concentrations.

WESTON

Data Qualifiers

<	=	Less than
>	=	Greater than

Analysis Summary:

Samples Collected: 07-14-89
Samples Prepared: 07-25-89
Samples Analyzed: 08-10-89

Approved By: ______________________
George Perry
HPLC Unit Leader
Lionville Analytical Laboratory

WESTON ANALYTICS
WIPE EXPLOSIVES DATA

RFW Batch Number: 8907L058 CLIENT: USATHAMA-HAWTHORNE

Sample Information				
	Client ID :	T3 SM REWIPE 3	---	---
	RFW#:	002	2XSS	10XSS
	D.F.:	1	1	1
	Units:	Total ug	Total ug	Total ug
HMX		< 12.7	2.36(92.9%)	11.8(92.9%)
RDX		< 9.80	1.75(89.2%)	8.95(91.3%)
1,3,5-TNB		< 20.9	3.84(91.8%)	18.8(90.0%)
1,3-DNB		< 5.90	1.15(97.4%)	5.66(95.9%)
NITROBENZENE		< 4.20	0.73(86.9%)	3.55(84.5%)
TETRYL		< 50.0	11.3(113%)	62.5(125%)
2,4,6-TNT		< 19.2	3.56(92.7%)	18.2(94.8%)
2,6-DNT		< 4.00	0.75(93.8%)	3.66(91.5%)
2,4-DNT		< 4.20	0.75(89.3%)	3.64(86.7%)

Sample Information		
	Client ID :	---
	RFW#:	10XSSD
	D.F.:	1
	Units:	Total ug
HMX		12.2(96.0%)
RDX		9.24(94.2%)
1,3,5-TNB		19.4(92.8%)
1,3-DNB		5.83(98.8%)
NITROBENZENE		3.59(85.4%)
TETRYL		66.9(134%)
2,4,6-TNT		19.0(99.0%)
2,6-DNT		3.64(91.0%)
2,4-DNT		3.68(87.6%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

2/2/90

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L058

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
001	T3 SM PREWIPE #2	NITRATED ESTERS	10.0	u	UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L05

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u	MG/L	5
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u	MG/L	5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L058

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L05

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L059

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T3 CHAMP WELL PW SP	NITRATED ESTERS	10.0	u	UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L059

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTIN LIMIT
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u	MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u	MG/L	5.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L059

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L05

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L154

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T3SMW2	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L15

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u	MG/L	2.
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u	MG/L	2.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L154

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99.3
		NITRATED ESTERS	49.5	2.5 u	50.0	99.0

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L1!

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

TEST RUN 5
500°F/24 HOURS

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
3907HW016

Client [illegible]

Work Order [illegible]

Date Rec'd. ______ Date Due ______

RFW Contact ______

Client Contact/Phone ______

		Refrigerator#				
		#/Type Container	VOA	[illegible]		
		Containers/Volume	[illegible]	[illegible]		
		Preservative	Cool	Cool		
		ANALYSES REQUESTED	[illegible]	[illegible]		
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected			
001	Ship [illegible] #1	WIPE	7-29-03	X		
002	Clay pipe	Soil	7-29-03		X	

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T5 PRE TEST

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch [illegible]
Installation [illegible]
Matrix: [illegible]

Analytical Lot
Date Prepared
Date Analyzed 7/26-7/31

Units [illegible] ug/g
Analyst [illegible]
Reviewed

Notes: Data is corrected for dilution.

Comment: T-5 ~~PRE~~ POST TEST

MATRIX	W	W	S								
LAB ID #	016-001	016-001	016-002								
SAMPLE DESCRIPTION	SHIP MINE	SHIP MINE	CLAY PIPE								
Dilution	1	10	10,000								
UNITS	Total ug	Total ug	ug/g								
HMX	43.9		<12700								
RDX	<9.80		<9800								
1,3,5-TNB	<20.9		<20900								
1,3-DNB	5.77J		<5900								
NB	<4.70		<4700								
Tetryl	<50.0		<50000								
2,4,6-TNT	<19.2		565,000								
2,6-DNT	<4.02		<4000								
2,4-DNT		133	<4200								
ANALYSIS DATE (1989)	7/26	7/31	7/26								

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8807HW011
Installation HAWTHORNE
Matrix: RINSATE & WIPE

Analytical Lot
Date Prepared
Date Analyzed 7/26/88

Units RINSATE-ug/L WIPE-total ug
Analyst [illegible]
Reviewed

Notes: Data is corrected for dilution,

Comment: TS PRE TEST

MATRIX	R	R	W	W	W	W	W	W	W	R	R
LAB ID #	011-001+002	011-005+006	011-009+012	011-013+016	011-013+016	011-017+020	011-021+024	011-025	011-026	012-001	012-002
SAMPLE DESCRIPTION	PR1 FLUSH #1 & #2	PR2 FLUSH #1 & #2	SR1 DECON WIPE 1-4	SR1 BOTTOM WIPE 1-4	SR1 BOTTOM WIPE 1-4	SR2 DECON WIPE 1-4	SR2 BOTTOM WIPE 1-4	BLANK WIPE OF PIPE	BLANK WIPE	SR1 [illegible] RINSE	SR2 [illegible] RINSE
Dilution	1	1	1	1	10	1	1	1	1	1000	1000
SAMPLE VOLUME (mL)	#1 500 #2 500	#1 500 #2 540	-	-	-	-	-	-	-	12.5	20
UNITS	ug/mL	ug/mL	total ug	total ug	total ug	total ug	total ug	total ug	total ug		
HMX	<0.635	<0.635	<12.7	209		<12.7	<12.7	<12.7	<12.7	<635	<635
RDX	<0.490	<0.490	<9.80		657	<9.80	<9.80	<9.80	<9.80	<490	<490
1,3,5-TNB	<1.05	<1.05	<20.9	<20.9		<20.9	<20.9	<20.9	<20.9	<1050	<1050
1,3-DNB	<0.295	<0.295	<5.89	<5.89		<5.89	<5.89	<5.89	<5.89	<295	<295
NB	<0.210	<0.210	<4.19	<4.19		<4.19	<4.19	4.58	<4.19	<210	<210
Tetryl	<2.5	<2.5	<50.0	<50.0		<50.0	<50.0	<50.0	<50.0	<2500	<2500
2,4,6-TNT	<0.960	<0.960	<19.2	<19.2		<19.2	<19.2	<19.2	<19.2	32,200	1300
2,6-DNT	0.200	<0.200	<4.00	<4.00		<4.00	<4.00	<4.00	<4.00	<200	<200
2,4-DNT	<0.210	<0.210	<4.20	5.78		<4.20	<4.20	<4.20	<4.20	<210	<210
CALC DATE (1988)	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/28	7/28

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

390BKW-018

Client: USATHAMA/HW/AAP
Work Order: 2281-08-02
Date Rec'd.: Date Due:
RFW Contact: MAzelon, N. Johnson
Client Contact/Phone: 215-430-3117

Refrigerator#	
#/Type Container	[illegible]
Containers/Volume	
Preservative	
ANALYSES REQUESTED ➡	Exp

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Exp
021	T5SHR1 R1 POST TEST	AQ	8/2/89	X
002	2	↓	↓	X
003	3	↓	↓	X
004	4	↓	↓	X
021	PB FIELD BLANK	AQ	8/02/89	X
022	CLAY PIPE FIELD BLANK	↓	↓	X
023	SHR FIELD BLANK	↓	↓	X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T-5 POST TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

2y

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
3908HW-018

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact M. MAZELON, N. JOHNSON
Client Contact/Phone 215-430-3117

Refrigerator#				
#/Type Container				VOA
Containers/Volume				
Preservative				
ANALYSES REQUESTED ➡				Exp
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**	
005	T-5 SSR 2 W1 TOP RACK	WIPE	8/2	X
006	2			X
007	3			X
008	4			X
009	T-5 SSR 2 W5 LWR RACK	WIPE	8/2/89	X
010	6			X
011	7			X
012	8			X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T-5 POST TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:
2 Ambient or Chilled
NOTES:
3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:
4 Properly Preserved
Y N
NOTES:
5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

1&2

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908HW-01E

Client USATHAMA/HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact MAZZOLA, N. JOHNSON
Client Contact/Phone 215-[illegible]-3117

Refrigerator#										
#/Type Container	[illegible]	VOA								
Containers/Volume										
Preservative										
ANALYSES REQUESTED ➡	EXP	EXP								

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	EXP	EXP								
013	T5 CP SOIL POST TEST	SOLID	8/2/89	X									
014	T5 PBLR 1	AQ	8/2	X									
015	2			X									
016	3			X									
017	4			X									
01? -001	T SSR1 SPIKE RINSATE	AQ	8/1/89	X	RINSATES for NEXT TEST								
01? -002	TSSR 2 SPIKE RINSATE	AQ	8/1/89	X									
018	T5 SH W1	WIPE	8/2		X								
019	T5 FLASH CHAMB. WALLS	WIPE	8/2		X								
020	T5 WIPE BLANK												

Matrix:
S - Soil W - Water DS - Drum Solids
SE - Sediment O - Oil DL - Drum Liquids
SO - Solid A - Air F - Fish
X - Other

Special Instructions: EXP- EXPLOSIVES
T-5 POST TEST SAMPLES
T- PRE TEST RINSATES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only
Samples Were:
1 Shipped or Hand-Delivered
NOTES:
2 Ambient or Chilled
NOTES:
3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:
4 Properly Preserved
Y N
NOTES:
5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-113

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

8908HL5020

Client USATHAMA / HWAAD
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact VIRAG / N. JOHNSON
Client Contact/Phone 25 430--3117

Refrigerator#	
#/Type Container	[illegible]
Containers/Volume	
Preservative	
ANALYSES REQUESTED	[illegible]

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected										
001	T5 MOTOR RINSE		8/4	X									
	(26) LITER VOLUME												
	BOTTLES 104 LITER TOTAL												

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: POST T-5 SAMPLE

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	C Young		8/4/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 3?08HG-018
Installation HAWTHORNE
Matrix: RINSATE WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/02/89

Units RINSATE-ug/mL WIPE-total ug SOIL-ug/g
Analyst GAM
Reviewed

Note: Data is corrected for dilution,

Comment: T-5 POST TEST

MATRIX	R	R	R	R	W	W	W	W	W	W	W
LAB ID #	018-001	018-002	018-003	018-004	018-005	018-006	018-007	018-008	018-009	018-010	018-011
SAMPLE DESCRIPTION	T5 SHEL RINSE 1	T5 SHEL RINSE 2	T5 SHEL RINSE 3	T5 SHEL RINSE 4	T5 SSR2 WIPE 1 TOP	T5 SSR2 WIPE 2 TOP	T5 SSR2 WIPE 3 TOP	T5 SSR2 WIPE 4 TOP	T5 SSR2 WIPE 5 BOTTOM	T5 SSR2 WIPE 6 BOTTOM	T5 SSR2 WIPE 7 BOTTOM
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mLs)	300	300	300	300	—	—	—	—	—	—	—
UNITS	ug/mL	ug/mL	ug/mL	ug/mL	total ug	total ug	total ug	total ug	total ug	total ug	total ug
HMX	<0.635	<0.635	<0.635	<0.635	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<0.490	<0.490	<0.490	<0.490	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89
NB	<0.210	<0.210	<0.210	<0.210	24.2 +	7.24 +	4.41 +	30.2 J	25.6 +	6.71 +	4.84 +
Tetryl	<2.5	<2.5	<2.5	<2.5	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<0.960	<0.960	<0.960	<0.960	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<0.200	<0.200	<0.200	<0.200	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00
2,4-DNT	<0.210	<0.210	<0.210	<0.210	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
QA/QC DATE (MEA)	8/02	8/02	8/02	8/02	8/02	8/02	8/02	8/02	8/02	8/02	8/02

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908H-018
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/10/89

Units RINSATE - ug/l, WIPE - total ug, SOIL - ug/g
Analyst GAD
Reviewed

Note: Data is corrected for dilution,

Comment: T-5 POST TEST

MATRIX	W	S	R	R	R	R	W	W	W	R	R
LAB ID #	018-012	018-013	018-014	018-015	018-016	018-017	018-018	018-019	018-020	018-021	018-022
SAMPLE DESCRIPTION	T5 SW2 WIPE B [illegible]	T5 CP SOIL	T5 PB1 RINSE 1	T5 PB1 RINSE 2	T5 PB1 RINSE 3	T5 PB1 RINSE 4	T5 SW WIPE 1	T5 FLASH [illegible] WALL	T5 WIPE [illegible]	PB FIELD BLANK	[illegible] FIELD BLANK
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (ml)	—	—	1000	1000	1000	1000	—	—	—	180	150
UNITS	total ug	ug/g	ug/l	ug/l	ug/l	ug/l	total ug	total ug	total ug	ug/l	ug/l
HMX	<12.7	.127	<0.635	<0.635	<0.635	<0.635	<12.7	<12.7	<12.7	<0.635	<0.635
RDX	<9.80	<0.980	<0.490	<0.490	<0.490	<0.490	<9.80	<9.80	<9.80	<0.490	<0.490
1,3,5-TNB	<20.9	<2.09	<1.05	<1.05	<1.05	<1.05	<20.9	<20.9	<20.9	<1.05	<1.05
1,3-DNB	<5.89	<0.589	<0.295	<0.295	<0.295	<0.295	<5.89	<5.89	5.89	<0.295	<0.295
NB	(3.56 J)	<0.419	<0.210	<0.210	<0.210	<0.210	20.1 *	11.5 *	9.21 *	<0.210	<0.210
Tetryl	<50.0	<5.0	<2.5	<2.5	<2.5	<2.5	<50.0	<50.0	<50.0	<2.5	<2.5
2,4,6-TNT	<19.2	<1.92	<0.960	<0.960	<0.960	<0.960	<19.2	<19.2	<19.2	<0.960	<0.960
2,6-DNT	<4.00	<0.400	<0.200	<0.200	<0.200	<0.200	<4.00	<4.00	<4.00	<0.200	<0.200
2,4-DNT	<4.20	<0.420	<0.210	<0.210	<0.210	<0.210	<4.20	<4.20	<4.20	<0.210	<0.210
QA/QC DATE (LINEAR)	8/02	8/02	8/02	8/02	8/02	8/02	8/02	8/02	8/02	8/04	8/04

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8309[illegible]1030
Installation [illegible]
Matrix: [illegible]

Analytical Lot
Date Prepared
Date Analyzed [illegible]

Units ug/L
Analyst [illegible]
Reviewed

Note: Data is corrected for dilution,

Comment: TS POST TEST

MATRIX	R	R									
LAB ID #	018-023	020-001									
SAMPLE DESCRIPTION	TS FIELD BLANK	TS [illegible]									
Dilution	1	1									
SAMPLE VOLUME (mls)	150	104,000									
UNITS	ug/L	ug/L									
HMX	<0.635	<0.635									
RDX	<0.490	<0.490									
1,3,5-TNB	<1.05	<1.05									
1,3-DNB	<0.265	<0.265									
NB	<0.210	<0.210									
Tetryl	<2.5	<2.5									
2,4,6-TNT	<0.560	<0.560									
2,6-DNT	<0.200	<0.200									
2,4-DNT	<0.210	<0.210									

Extraction date (water) 9104, 9104

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA HAWTHORNE
RFW #: 8908L203, OIL
W.O.#: 2281-08-07

SAMPLES RECEIVED: 08-01-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of oil samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS	=	Designates sample spiked with target compound.
MSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

<	=	Less than
>	=	Greater than

Analysis Summary:

Samples Collected: 07-28-89
Samples Prepared: 08-04-89
Samples Analyzed: 08-10-89

Approved By: [signature]
for George Perry
HPLC Unit Leader
Lionville Analytical Laboratory

WESTON ANALYTICS
OIL EXPLOSIVES DATA

RFW Batch Number: 8908L203	CLIENT:	USATHAMA-HAWTHORNE		Page: 1
Sample Information Client ID:	PRE T5 GEAR OIL	PRE T5 GEAR OIL	PRE T-5 GEAR OIL	---
RFW#:	004	004 MS	004 MSD	BLANK
D.F.:	1	1	1	1
Units:	ug/g	ug/g	ug/g	ug/g
HMX	< 144	2610(98.4%)	2610(98.4%)	< 254
RDX	2130G	3750(141%)	5000G(NR)	< 196
1,3,5-TNB	< 237	4180(95.7%)	4180(95.7%)	< 418
1,3-DNB	< 66.8	1230(100%)	1230(100%)	< 118
NITROBENZENE	< 47.6	729(83.0%)	729(83.0%)	< 84
TETRYL	< 566	15000(144%)	15000(144%)	< 1000
2,4,6-TNT	< 217	4180(104%)	4180(104%)	< 381
2,6-DNT	< 45.3	800(95.8%)	800(95.8%)	< 80
2,4-DNT	< 47.6	840(96.0%)	840(96.0%)	< 84

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/21/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L203

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	POST TS-FLSH CHMB WA	NITRATED ESTERS	5.0	u	UG	5.0
-002	POST T2-SHIP MINE	NITRATED ESTERS	5.0	u	UG	5.0
-003	PRE T5-SHIP MINE	NITRATED ESTERS	5.0	u	UG	5.0
-005	PRE T5-BLANK WIPE	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u	MG/L	2.
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u	MG/L	2.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99
		NITRATED ESTERS	49.5	2.5 u	50.0	99.

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L2

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T5 FLASH CHMB WALL	NITRATED ESTERS	5.0 u	UG	5.0
-002	T5 SMW2 POST TEST	NITRATED ESTERS	5.6	UG	5.0
-003	T-8 SMW2 POST TEST	NITRATED ESTERS	13.0	UG	5.0
-004	T-8 WIPE BLANK PRE-	NITRATED ESTERS	5.8	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L2

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L2

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

TEST RUN 8
400°F/36 HOURS

WESTON Analytics Use Only
017

Custody Transfer Record/Lab Work Request

WESTON '8

Client USATHAMA/HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact MAZELON, COSMOS, JOHNSON
Client Contact/Phone 215-430-3117

Refrigerator#						
#/Type Container			ECOM AMBER		VOA	
Containers/Volume			4		40ml	
Preservative			001			
ANALYSES REQUESTED			EXP			
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**			
001	T PB1 RINSE 1	AQ	7/3	X		
002	2			X		
003	3			X		
004	4			X		
005	T PB2 RINSE 1	AQ	7/31/89	X		
006	2			X		
007	3			X		
008	4			X		
009	T SSR1 WIPE 1 UPPER	WIPE	7/31/89	~~X~~		X
010	2			~~X~~		X
011	3			~~X~~		X
012	4			~~X~~		X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: EXP - EXPLOSIVES T8
ALL SAMPLES ARE PRE-TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

2g

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

017

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact MAZELON, N. ROBINSON, COSGRO
Client Contact/Phone 215-430-3117

Refrigerator#	
#/Type Container	1 w/g
Containers/Volume	10 ml
Preservative	
ANALYSES REQUESTED	Exp

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Exp
013	T SSR 1 WIPE 5 Lower	WIPE	7/31/89	X
014	6	↓	↓	X
015	7	↓	↓	X
016	8	↓	↓	X
017	T SSR 2 WIPE 1 UPPER	WIPE	7/31/89	X
018	2	↓	↓	X
019	3	↓	↓	X
020	4	↓	↓	X
021	TSSR 2 WIPE 5 LOWER	WIPE	7/31/89	X
022	6	↓	↓	X
023	7	↓	↓	X
024	8	↓	↓	X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: EXP = EXPLOSIVES T8

All SAMPLES ARE PRE-TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/86

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908HW-019

Client: USATHAMA/THWAAP
Work Order: 2281-08-02
Date Rec'd. ________ Date Due ________
RFW Contact: MAZELON, N. TRIWEM
Client Contact/Phone: 215 430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator# / #/Type Container / Containers/Volume / Preservative / ANALYSES REQUESTED → TCP								
001	T-8 CP SOLID PRETEST	SOLID	8/3/89	X								
002	T-8 SM WI PRETEST	WIPE	8/3/89	X								
003	T-8 SM WIPE BLANK PRETEST	WIPE	8/3/89	X								
004	T-8 CP FIELD BLANK PRE	AQ	8/3/89	X								
005	T-8 SteelPIPE WAX RINSATE	AQ	8/3/89	X								
006	T-8 SSR1 SPIKE RINSATE	AQ	8/11/89	X								
007	T-8 SSR2 SPIKE RINSATE	↓	↓	X								

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: All SAMPLES are PRE TEST T-8 SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907HW017 / 019
Installation [illegible]
Matrix: [illegible]

Analytical Lot
Date Prepared
Date Analyzed 7/31/89 8/14/89

Units [illegible]
Analyst [illegible]
Reviewed

Note: Data is corrected for dilution,

Comment: T-8 PRE TEST

MATRIX	R	R	W	W	W	W	W	S	W	W	W
LAB ID #	017-001-4004	017-005-4008	017-009-4012	017-013-4016	017-013-4016	017-017-4020	017-021-4024	019-001	019-002	019-002	019-003
SAMPLE DESCRIPTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dilution	1	1	1	1	10	1	1	1000	1	100	1
SAMPLE VOLUME (mls)	250 / 250 / 250 / 250	250 / 250 / 250 / 250	—	—	—	—	—	—	—	—	—
UNITS	ug/mL	ug/mL	total ug	total ug	total ug	total ug	total ug	ug/g	total ug	total ug	total ug
HMX	<0.675	<0.675	9.12 J	560		<12.7	<12.7	<1270	62.8		<12.7
RDX	<0.490	<0.490	28.5		1470	<9.80	<9.80	<980	<9.80		<9.80
1,3,5-TNB	<1.05	<1.05	<20.9	<20.9		<20.9	<20.9	<2090	<20.9		<20.9
1,3-DNB	<0.295	<0.295	<5.90	<5.90		<5.90	<5.90	<590	51.1		<5.90
NB	<0.210	<0.210	18.7	19.7		[illegible]	34.8	<41.7	7.30		4.91
Tetryl	<2.50	<2.50	<50.0	<50.0		<50.0	<50.0	<5000	55.0		<50.0
2,4,6-TNT	<0.960	<0.960	<19.2	146		<19.2	42.8	57600	24.8		<19.2
2,6-DNT	<0.200	<0.200	<4.00	<4.00		<4.00	<4.00	<400	<4.00		<4.00
2,4-DNT	<0.210	<0.210	<4.20	<4.20		<4.20	<4.20	<420		5410	<4.20
QA/QC DATE [illegible]	7/31	7/31	7/31	7/31	7/31	7/31	7/31	8/14	8/06	8/06	8/06

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch [illegible]
Installation [illegible]
Matrix: [illegible]

Analytical Lot
Date Prepared
Date Analyzed [illegible]

Units [illegible]
Analyst [illegible]
Reviewed

Note: Data is corrected for dilution,

Comment: T-9 PRE TEST

MATRIX	R	R	R	R	R						
LAB ID #	019-004	019-005	019-005	019-006	019-007						
SAMPLE DESCRIPTION	T-9 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
Dilution	1	1	10	1000	1000						
SAMPLE VOLUME (mls)	90	310	310	31	31						
UNITS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
HMX	<0.625	<0.625		<625	<625						
RDX	<0.490	<0.490		<490	<490						
1,3,5-TNB	<1.05	<1.05		<1050	<1050						
1,3-DNB	<0.395	<0.395		<395	<395						
NB	<0.310	<0.310		[illegible]	[illegible]						
Tetryl	<2.6	<2.6		<2600	<2600						
2,4,6-TNT	<0.360		348	5800	6700						
2,6-DNT	<0.300	<0.300		<300	<300						
2,4-DNT	<0.310	<0.310		<310	<310						
DATE (PREP)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 9908[illegible]
Installation [illegible]
Matrix: [illegible] Wipe & Soil

Analytical Lot
Date Prepared
Date Analyzed [illegible]

Units [illegible]
Analyst [illegible]
Reviewed

Note: Data is corrected for dilution,

Comment: T-9 PRE TEST

MATRIX	R	R	R	R	R						
LAB ID #	019-004	019-005	019-005	019-006	019-007						
SAMPLE DESCRIPTION	T-9 CF [illegible]	T-9 Steel Pipe [illegible]	T-9 Steel Pipe [illegible]	T-9 [illegible]	T-9 [illegible]						
Dilution	1	1	10	1000	1000						
SAMPLE VOLUME (mL)	90	310	310	31	31						
UNITS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
HMX	<0.635	<0.635		<635	<635						
RDX	<0.490	<0.490		<490	<490						
1,3,5-TNB	<1.05	<1.05		<1050	<1050						
1,3-DNB	<0.395	<0.395		<395	<395						
NB	<0.210	<0.210		<210	<210						
Tetryl	<2.6	<2.6		<2600	<2600						
2,4,6-TNT	<0.360		348	6800	6700						
2,6-DNT	<0.300	<0.300		<300	<300						
2,4-DNT	<0.310	<0.310		<310	<310						
EXTRACT DATE (1994)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908HW022

Client USATHAMA/HWAAP
Work Order 2381-08-02
Date Rec'd. 8-8-81 Date Due
RFW Contact N. Johnson
Client Contact/Phone (215) 430-3117

Refrigerator #				
#/Type Container			Amber	
Containers/Volume			500ml.	
Preservative			cool	
ANALYSES REQUESTED			Explosives	

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
012	T8-SP-R1	ACN	8-8-81	X
013	R2	↓	↓	X
014	R3	↓	↓	X
015	R4	↓	↓	X
016	T8-PB1-R1	ACN	8-8-81	X
017	R2	↓	↓	X
018	R3	↓	↓	X
019	R4	↓	↓	X
020	T8-SHB1-R1	N	8-8-89	X
021	R2	↓	↓	X
022	R3	↓	↓	X
023	R4	↓	↓	X
024	T8-CP-Soil	Soil	8-8-81	X
025	T8-CP-Scoop-Field Blank R1	ACN	8-8-89	X
026	T8-Field Blank-Beaker Rinse	ACN	8-8-89	X

Matrix: 027
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions:

T8 Post Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	K. Schuck		8-8-89	5:32PM					

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-8/88

7-118

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908HW023

Client USATHAMA / HWAAP
Work Order 22 P.1-08-02
Date Rec'd. 8/9/89 Date Due
RFW Contact Nancy Johnson
Client Contact/Phone (215) 430-3117

Refrigerator#											
#/Type Container			Air								
Containers/Volume			9x4								
Preservative											
ANALYSES REQUESTED ➡			Explosives								
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected								
001	T8 PB2 R1	Air	8/8/89	X							
002	↓ ↓ R2	↓	↓	X							
003	↓ ↓ R3	↓	↓	X							
004	↓ ↓ R4	↓	↓	X							

Matrix:
S - Soil W - Water DS - Drum Solids
SE - Sediment O - Oil DL - Drum Liquids
SO - Solid A - Air F - Fish
X - Other

Special Instructions: T-8 POST TEST Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 8908HW022 Analytical Lot ______ Units [illegible] soil - ug/g
Installation HAWTHORNE Date Prepared ______ Analyst gam
Matrix: RINSATE, WIPE & SOIL Date Analyzed 8/29/89 Reviewed ______

Notes: Data is corrected for dilution,

Comment: T-3 POST TEST

MATRIX	W	W	W	W	W	W	[illegible]	W	W	W	W
LAB ID #	022-001	022-002	022-003	022-004	022-005	022-006	022-007	022-008	022-009	022-010	022-011
SAMPLE DESCRIPTION	T-3 [illegible] WIPE 1	T-B [illegible] WIPE 2	T-3 [illegible] WIPE 3	T-B [illegible] WIPE 4	T-B [illegible] WIPE 5	T-B [illegible] WIPE 6	T-B [illegible] WIPE 7	T-B [illegible] WIPE 8	T-B [illegible]	T-B [illegible]	T-B WIPE [illegible]
Dilution	1	1	1	1	1	1	1	1	1		1
SAMPLE VOLUME (mls)	-	-	-	-	-	-	-	-	-	-	-
UNITS	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
NB	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00
2,4-DNT	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
QA/QC DATE (mes)	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 8908HW022
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 9/02/89

Units RINSATE-ug/L WIPE-[illegible] ug SOIL ug/g
Analyst DAM
Reviewed

Note: Data is corrected for dilution,

Comment: T.B POST TEST

MATRIX	R	R	R	R	R	R	R	R	R	R	R
LAB ID #	022-012	022-013	022-014	022-015	022-016	022-017	022-018	022-019	022-020	022-021	022-022
SAMPLE DESCRIPTION	T-B SP RINSE 1	T-B SP RINSE 2	T-B SP RINSE 3	T-B SP RINSE 4	T-B FBI RINSE 1	T-B FBI RINSE 2	T-B FBI RINSE 3	T-B FBI RINSE 4	T-B SHRI RINSE 1	T-B SHRI RINSE 2	T-B SHRI RINSE 3
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (MLS)	1000	1000	1000	1000	1000	1000	1000	1000	300	300	300
UNITS	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
HMX	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<0.960	<0.960	<0.960	<0.960	1.13	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960
2,6-DNT	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
2,4-DNT	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
QA/QC DATE (INIT)	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908HW007
Installation HAWTHORNE
Matrix: RINSATE WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/10/89

Units RINSATE-ug/mL WIPE-total ug, SOIL-ug/g
Analyst GARA
Reviewed

Note: Data is corrected for dilution,

Comment: T-8 POST TEST

MATRIX	R	S	R	R	R	R	R	R	R	R	
LAB ID #	022-023	022-024	022-025	022-026	022-027	023-001	023-002	023-003	023-004	022-016 DUP	
SAMPLE DESCRIPTION	T-8 [illegible]	T-8 [illegible] SOIL	T-8 [illegible] FIELD DUP	T-8 FIELD BLK [illegible]	T-8 FIELD BLK [illegible]	T-8 PIT [illegible] 1	T-8 PIT [illegible] 2	T-8 PIT [illegible] 3	T-8 PIT [illegible] 4	T-8 PIT [illegible] 1	
Dilution	1	1	1	1	1	1	1	1	1	1	
SAMPLE VOLUME (mLs)	300	-	250	250	300	1000	1000	1000	1000	1000	
UNITS	ug/mL	ug/g	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	ug/mL	
HMX	<0.635	<1.27	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	
RDX	<0.490	<0.980	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	
1,3,5-TNB	<1.05	<2.09	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	
1,3-DNB	<0.295	<0.590	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	
NB	<0.210	<0.420	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	
Tetryl	<2.5	<5.0	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	
2,4,6-TNT	<0.960	5.03	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	1.29	
2,6-DNT	<0.200	<0.400	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	
2,4-DNT	<0.210	<0.420	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	
QA/QC DATE (1989)	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 9010C 010210 Analytical Lot ______ Units RINSATE-ug/mL WIPE-TOTAL ug SOIL-ug/g
Installation HAWTHORNE Date Prepared ______ Analyst [illegible]
Matrix: RINSATE, WIPE & SOIL Date Analyzed [illegible] Reviewed ______

Note: Data is corrected for dilution,

Comment:

MATRIX	R	R	W	W	S	S					
LAB ID #	BLANK	10X	BLANK	10X	BLANK	10X					
	RINSATE	RINSATE SPIKE	WIPE	WIPE SPIKE	SOIL	SOIL SPIKE					
Dilution	1	1	1	1	1	1					
UNITS	ug/mL	ug/mL	Total ug	Total ug	ug/g	ug/g					
HMX	<0.635	105% 6.65	<12.7	101% 131	<1.27	91% 12.6					
RDX	<0.490	96% 4.70	<9.60	93% 915	<0.960	88% 8.58					
1,3,5-TNB	<1.05	94% 9.8	<20.9	90% 189	<2.09	91% 19.0					
1,3-DNB	<0.295	93% 2.15	<5.90	90% 531	<0.590	[illegible] 5.44					
NB	<0.210	97% 2.03	<4.20	[illegible] 39.6	<0.420	92% 4.15					
Tetryl	<2.5	93% 23.2	<50.0	92% 455	<5.0	90% 45.1					
2,4,6-TNT	<0.960	91% 7.95	<19.2	83% 160	<1.92	83% 16.0					
2,6-DNT	<0.200	103% 2.06	<4.00	99% 39.4	<0.400	[illegible] 4.11					
2,4-DNT	<0.210	90% 1.89	<4.20	87% 36.7	<0.420	[illegible] 3.83					

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/21/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T5 FLASH CHMB WALL	NITRATED ESTERS	5.0	u	UG	5.0
-002	T5 SMW2 POST TEST	NITRATED ESTERS	5.6		UG	5.0
-003	T-8 SMW2 ~~POST~~ PRE TEST	NITRATED ESTERS	13.0		UG	5.0
-004	T-8 WIPE BLANK PRE-	NITRATED ESTERS	5.8		UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L25

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L2

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T-8-SM-W2 POST TEST	NITRATED ESTERS	5.3		UG	5.0
-002	T-8-CHAMBER WALL-W2	NITRATED ESTERS	7.5		UG	5.0
-003	T8-WIPE BLANK W2 POS	NITRATED ESTERS	5.0	u	UG	5.0
-004	T13-SM-W-2 PRE TEST	NITRATED ESTERS	12.5		UG	5.0
-005	T13-WIPE BLANK W2 ET	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L31

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

TEST RUN 13
500°F/12 HOURS

WESTON Analytics Use Only

8708H0021

Custody Transfer Record/Lab Work Request

WESTON

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ________ Date Due ________
RFW Contact YOUNG, N. JOHNSON
Client Contact/Phone (215) 430-3117

Refrigerator#	
#/Type Container	
Containers/Volume	AMBER 500ml
Preservative	
ANALYSES REQUESTED	Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
001	T13 P31 RINSATE R1	ACN	8/7/89	X
002	R2			X
003	R3			X
004	R4			X
005	T13 P32 RINSATE R1	ACN		X
006	R2			X
007	R3			X
008	R4			X
009	T13 CP SOIL	SOLID		X
010	FIELD BLANK	ACN		X
011	T13 SSR1 SAME RINSATE	ACN		X
012	T13 SSR2 SPIKE RINSATE	ACN		X
013	T13 PB FIELD BLANK RINSATE	ACN		X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T13 PRETEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	C.Young		8/7/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only

8908HW021

Client: USATHAMA / HWAAP

Work Order: 2281-08-07

Date Rec'd. ______ Date Due ______

RFW Contact: YOUNG / M. JOHNSON

Client Contact/Phone: (215) 430-3117

Refrigerator#					
#/Type Container	VOA				
Containers/Volume					
Preservative					
ANALYSES REQUESTED	Explos				

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explos
014	T13 SSR1 W1 UPPER	WPS		X
015	W2			X
016	W3			X
017	W4			X
018	W5 LOWER			X
019	W6			X
020	W7			X
021	W8			X
022	T13 SSR2 W1 UPPER			X
023	W2			X
024	W3			X
025	W4			X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T-13 PRETEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	G. Young		8/7/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908HW021

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd.: ______ Date Due: ______
RFW Contact: YOUNG / N. JOHNSON
Client Contact/Phone: (215) 430-317

Refrigerator#					
#/Type Container	VIAL	Al-foil			
Containers/Volume		500			
Preservative					
ANALYSES REQUESTED	Explosives				

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected										
026	T13 SSB2 W5 LOWER	WIPE		X									
027	W6			X									
028	W7			X									
029	W8			X									
030	T13 WIPE BLANK	WIPE		X									
031	T13 SM W1	WIPE		X									
032	T13 AP1 SPIKE RINSATE	ACN			X								
033	T13 AP2 SPIKE RINSATE	ACN			X								

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special instructions: T-13 PRETEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	C. YOUNG		8/7/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 9909H-0021
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 08/09/89

Units RINSATE-ug/L WIPE-total ug SOIL-ug/g
Analyst
Reviewed

Note: Data is corrected for dilution,

Comment: T-13 PRE TEST

MATRIX	R	R	S	R	R	R	R	W	W	W	W
LAB ID #	021-001-4004	021-005-4008	021-009	021-010	021-011	021-012	021-013	021-014-4017	021-018-4021	021-022-4025	021-026-4029
SAMPLE DESCRIPTION	T-13 RA1 [illegible]	T-13 RA2 [illegible]	T-13 CP SOIL	T-13 CP FIELD [illegible]	T-13 SOIL [illegible]	T-13 SOIL [illegible]	T-13 FB FIELD BLANK	T-13 [illegible] W1-4	T-13 [illegible]	T-13 [illegible] W1-4	T-13 [illegible]
Dilution	1	1	10,000	1	1000	100	1	1	1	1	1
SAMPLE VOLUME (mls)	#1 250 #2 250 #3 250 #4 250	#1 250 #2 250 #3 250 #4 250	—	240	34	36	250	—	—	—	—
UNITS	ug/L	ug/L	ug/g	ug/L	ug/L	ug/L	ug/L	total ug	total ug	total ug	total ug
HMX	<0.635	<0.635	<12700	<0.635	<635	<63.5	<0.635	<12.7	<12.7	<12.7	<12.7
RDX	<0.490	<0.490	<9800	<0.490	<490	<49.0	<0.490	<9.80	<9.80	<9.80	<9.80
1,3,5-TNB	<1.05	<1.05	<20700	<1.05	<1050	<105	<1.05	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<0.295	<0.295	<5900	<0.295	<295	<29.5	<0.295	<5.90	<5.90	<5.90	<5.90
NB	<0.210	<0.210	<4200	<0.210	<210	<21.0	<0.210	<4.20	3.36 J*	<4.20	8.25*
Tetryl	<2.5	<2.5	<50000	<2.5	<2500	<250	<2.5	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<0.960	<0.960	505000	<0.960	9800	2490	<0.960	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<0.200	<0.200	<4000	<0.200	<200	<20.0	<0.200	<4.00	<4.00	<4.00	<4.00
2,4-DNT	<0.210	<0.210	<4200	<0.210	<210	<21.0	<0.210	<4.20	<4.20	<4.20	<4.20
ANALYSIS DATE	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9	8/9

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 9303H1.0021
Installation HAWTHORNE
Matrix: GUNNITE WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 3/09/93

Units GUNNITE-ug/wipe WATER-ug/L Soil-ug/g
Analyst QAN
Reviewed

Notes: Data is corrected for dilution,

Comment: T-13 PRE TEST

MATRIX	W	W	R	R	R	R					
LAB ID #	021-030	021-031	021-032	021-032	021-033	021-033					
SAMPLE DESCRIPTION	T13 WIPE BLANK	T13 5in W1	T13 RR2 FIRST RUN	T13 RR2 SPIKE RUN	T13 RR3 SPIKE RUN	T13 RR3 SPIKE RUN					
Dilution	1	1	10	100	10	100					
SAMPLE VOLUME (ml)	—	—	250	250	250	250					
UNITS	Total ug	Total ug	ug/ml	ug/ml	ug/ml	ug/ml					
HMX	<12.7	57.7	<6.35		<6.35						
RDX	<9.80	<9.80	<4.90		<4.90						
1,3,5-TNB	<20.9	<20.9	<10.5		<10.5						
1,3-DNB	<5.90	<5.90	<2.95		<2.95						
NB	2.94 J*	<4.20	<2.10		<2.10						
Tetryl	<50.0	<50.0	<25		<25						
2,4,6-TNT	<19.2	<19.2		3960		2290					
2,6-DNT	<4.00	<4.00	<2.00		<2.00						
2,4-DNT	<4.30	46.7	5.75		2.30						
ANALYSIS DATE (1993)	3/9	3/9	3/9	3/9	3/9	3/9					

J – PRESENT LESS THAN DETECTION LIMIT.

1 of 2

WESTON

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
3908HW0025

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Sulacka / Nancy Johnson
Client Contact/Phone: (215) 430-3117

Refrigerator#	
#/Type Container	VOA
Containers/Volume	
Preservative	Cool
ANALYSES REQUESTED	Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
001	T13 SSR1 W1 upper	wipe	8-14-89	X
002	W2	↓	↓	X
003	W3	↓	↓	X
004	W4	↓	↓	X
005	W5 lower	↓	↓	X
006	W6	↓	↓	X
007	W7	↓	↓	X
008	W8	↓	↓	X
009	T13 SM W1 (ACN)	wipe	8-14-89	X
010	T13 Chamber Walls W1 (ACN)	wipe	8-14-89	X
011	T13 Wipe Blank W1 (ACN)	wipe	8-14-89	X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T13 Post TEST SAMPLES.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R.T. Sulacka		8/14/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON 94 8.3

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
8903HW025

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Salacka / N. Johnson
Client Contact/Phone: (215) 430-3117

Refrigerator#			
#/Type Container			1/Amber
Containers/Volume			500 ml
Preservative			Cool
ANALYSES REQUESTED			Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
012	T13 CP - Soil	Soil	8-14-89	X
013	T13 Field Blank Rinse R1	ACN	8-14-89	X
014	T13 PB2 R1 Post	ACN	8-14-89	X
015	R2 ↓	↓	↓	X
016	R3			X
017	R4			X
018	T13 PB-Field Blank R1	ACN	8-14-89	X
019	T13 AP1 R1 Post	ACN	8-14-89	X
020	R2 ↓	↓	↓	X
021	R3			X
022	R4			X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions:
T13 Post Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R. L. Salacka		8/14/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8908KW025

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Sabcka / N. Johnson
Client Contact/Phone: (215) 430-3117

Refrigerator#	
#/Type Container	Amber
Containers/Volume	500ml
Preservative	cool
ANALYSES REQUESTED	Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
023	T13 SHRI R1 Post	ACN	8-14-89	X
024	R2 Post	↓	↓	X
025	R3 ↓			X
026	R4			X
027	T13 SHRI Field Blnk R1	ACN	8-14-89	X

Matrix: S - Soil; SE - Sediment; SO - Solid; W - Water; O - Oil; A - Air; DS - Drum Solids; DL - Drum Liquids; F - Fish; X - Other

Special Instructions: T13 Post Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R.T. Sabcka		8/14/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 8808H0025
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/14/88

Units RINSATE-ug/ml WIPE-total ug SOIL-ug/g
Analyst DPM
Reviewed

Note: Data is corrected for dilution,

Comment: T-13 POST TEST

MATRIX	W	W	W	W	W	W	W	W	W	W	W
LAB ID #	025-001	025-002	025-003	025-004	025-005	025-006	025-007	025-008	025-009	025-010	025-011
SAMPLE DESCRIPTION	T13 SSR1 W1(UPPER)	T13 SSR1 W2	T13 SSR1 W3	T13 SSR1 W4	T13 SSR1 W5(LOWER)	T13 SSR1 W6	T13 SSR1 W7	T13 SSR1 W8	T13 SM W1	T13 CHAMBER WALL W1	T13 WIPE BLK W1
Dilution	1	1	1	1	1	1	1	1	1	1	1
(mls) SAMPLE VOLUME	—	—	—	—	—	—	—	—	—	—	—
UNITS	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
NB	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<19.2	<19.2	<19.2	<19.2	<19.2	17.4J	<19.2	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00
2,4-DNT	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
QA/QC DATE (1988)	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14

J - PRESENT, LESS THAN DETECTION LIMITS.

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908HW025
Installation HAWTHORNE
Matrix: RINSATE WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/14/89

Units RINSATE - ug/ml WIPE - Total ug SOIL - ug/g
Analyst QAM
Reviewed

Note: Data is corrected for dilution,

Comment: T-13 POST TEST

MATRIX	S	R	R	R	R	R	R	R	R	R	R
LAB ID #	025-012	025-013	025-014	025-015	025-016	025-017	025-018	025-019	025-020	025-021	025-022
SAMPLE DESCRIPTION	T13 CP SOIL	T13 FIELD BLK RINSE	T13 PB2 R1	T13 PB2 R2	T13 PB2 R3	T13 PB2 R4	T13 PB FIELD BLK	T13 AP1 R1	T13 AP1 R2	T13 AP1 R3	T13 AP1 R4
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mls)	-	250	1000	1000	1000	1000	250	1000	1000	1000	1000
UNITS	ug/g	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
HMX	<1.27	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.980	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB	<2.09	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.590	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.420	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl	<5.0	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	174.5	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960
2,6-DNT	<0.400	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
2,4-DNT	<0.420	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
QA/QC DATE	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14	8/14

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 5908HW025
Installation HAWTHORNE
Matrix: RINSATE WIPE 1 SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/14/89

Units RINSATE - ug/ml WIPE - total ug SOIL -
Analyst QAM
Reviewed

Notes: Data is corrected for dilution.

Comment: T-13 POST TEST

MATRIX	R	R	R	R	R						
LAB ID #	025-023	025-024	025-025	025-026	025-027						
SAMPLE DESCRIPTION	T13 SHR1 R1	T13 SHR1 R2	T13 SHR1 R3	T13 SHR1 R4	T13 SHR1 FIELD BLK						
Dilution	1	1	1	1	1						
SAMPLE VOLUME (mLs)	300	300	300	300	260						
UNITS	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml						
HMX	<0.635	<0.635	<0.635	<0.635	<0.635						
RDX	<0.490	<0.490	<0.490	<0.490	<0.490						
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05						
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295						
NB	<0.210	<0.210	<0.210	<0.210	<0.210						
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5						
2,4,6-TNT	<0.960	<0.960	<0.960	<0.960	<0.960						
2,6-DNT	<0.200	<0.200	<0.200	<0.200	<0.200						
2,4-DNT	<0.210	<0.210	<0.210	<0.210	<0.210						
QA/QC DATE (1989)	8/14	8/14	8/14	8/14	8/14						

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11.20
RFW #: 8307L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/4/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable; result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3[illegible]

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORT LIMIT
-001	T-8-SM-W2 POST TEST	NITRATED ESTERS	5.3		UG	[illegible]
-002	T-8-CHAMBER WALL-W2	NITRATED ESTERS	7.5		UG	[illegible]
-003	T8-WIPE BLANK W2 POS	NITRATED ESTERS	5.0	u	UG	[illegible]
-004	T13-SM-W-2 PRE TEST	NITRATED ESTERS	12.5		UG	[illegible]
-005	T13-WIPE BLANK W2 ET	NITRATED ESTERS	5.0	u	UG	[illegible]

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT		SPIKED AMOUNT	%R
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5	u	10.0	
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5	u	50.0	1
		NITRATED ESTERS	51.8	2.5	u	50.0	1

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORT LIMIT
-001	POST T13 SM WS (ETOH	NITRATED ESTERS	5.0	u	UG	
-002	POST T13FC CH WAL W2	NITRATED ESTERS	5.0	u	UG	
-003	POST T13 WIPE BL W2	NITRATED ESTERS	7.5		UG	
-004	PRE T14 SMW2 (ETOH)	NITRATED ESTERS	5.0	u	UG	
-005	PRE T14 WIPE BL W2	NITRATED ESTERS	5.0	u	UG	

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L398

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L[illegible]

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RI
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	[illegible]
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	1[illegible]
		NITRATED ESTERS	51.8	2.5 u	50.0	1[illegible]

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L398

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

TEST RUN 14
400°F/12 HOURS

WESTON Analytics Use Only

8708H0024

Custody Transfer Record/Lab Work Request

WESTON '8—

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd.: ________ Date Due: ________
RFW Contact: Salacka, Nancy Johnson
Client Contact/Phone: (215) 430-3117

		Refrigerator#									
		#/Type Container	VOA								
		Containers/Volume									
		Preservative	cool								
		ANALYSES REQUESTED	Explosives								
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**								
001	T14 SSR1 W1 upper	wipe	8-14-87	X							
002	W2			X							
003	W3			X							
004	W4			X							
005	W5 lower			X							
006	W6			X							
007	W7			X							
008	W8			X							
009	T14 SSR2 W1 upper	Wipe	8-14-87	X							
010	W2			X							
011	W3			X							
012	W4			X							
013	W5 lower			X							
014	W6			X							
015	W7			X							

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T14 Pre-test samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	Rita Salacka		8-14-87						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

2 83

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

8908 HUX024

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ____ Date Due ____
RFW Contact Salacka / N. Johnson
Client Contact/Phone (215) 430-3117

		Refrigerator#				
		#/Type Container		VOA	Amber	
		Containers/Volume			500ml	
		Preservative		Cool	Cool	
		ANALYSES REQUESTED ➡		Explosives		
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**			
016	T14 SSR2 W8 Tower	Wipe	8-14-89	X		
017	T14 SM W1 (ACN)	Wipe	8-14-89	X		
019	T14 Wipe Blank W1 (ACN)	Wipe	8-14-89	X		
019	T14 CP Soil	Soil	8-14-89		X	
020	T14 Field Blank Rinse-Scoop	ACN	8-14-89		X	
021	T14 PB1 R1	ACN	8-14-89		X	
022	R2	↓	↓		X	
023	R3	↓	↓		X	
024	R4	↓	↓		X	

Matrix:
S - Soil, SE - Sediment, SO - Solid
W - Water, O - Oil, A - Air
DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T14 Pre-Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R. T. Salacka		8-22-89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/38

7-115

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

WESTON 3 of 3

Client USATHAMA / HWAAP
Work Order 2381-08-02
Date Rec'd. ______ Date Due ______
RFW Contact Szlacka / N. Johnson
Client Contact/Phone (215) 430-3117

Refrigerator#
#/Type Container: Amber
Container Volume: 40ml
Preservative: Cool
ANALYSES REQUESTED: Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
025	T14 PB2 R1	ACN	8-14-89	X
026	R2	↓	↓	X
027	R3			X
028	R4			X
029	T14 PB Field Blank R1	ACN	8-14-89	X
030	SP1 Spike Rinsate	ACN	8-14-89	X
031	SP2 Spike Rinsate			
~~031~~	~~SHR1 Spike Rinsate~~	~~ACN~~	~~8-14-89~~	X
~~032~~	~~SHR2 Spike Rinsate 2~~	~~ACN~~	~~8-14-89~~	X
032	T14 SSR1 Spike Rinsate	ACN	8-14-89	X
033	T14 SSR2 Spike Rinsate	ACN	8-14-89	X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T14 Pre Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	K.T. Szlacka		8/14/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908HW024
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 9/14/89

Units RINSATE - ug/ml WIPE - total ug SOIL - ug/g
Analyst Gym
Reviewed

Note: Data is corrected for dilution,

Comment: T-14 PRE TEST

MATRIX	W	W	W	W	W	W	S	R	R	R	R
LAB ID #	024-001→004	024-005→008	024-009→012	024-013→016	024-017	024-018	024-019	024-020	024-021→024	024-025→028	024-029
SAMPLE DESCRIPTION	T14 SSR1 W1→W4	T14 SSR1 W5→W8	T14 SSR2 W1→W4	T14 SSR2 W5→W8	T14 SM W1	T14 WIPE BLK W1	T14 CP SOIL	T14 FIELD BLK SCOOP	T14 PB1 R1→R4	T14 PB2 R1→R4	T14 FD FIELD BLK
Dilution	1	1	1	1	1	1	10,000	1	1	1	1
SAMPLE VOLUME (mls)	–	–	–	–	–	–	–	250	R1 250 R2 250 R3 250 R4 250	R1 250 R2 250 R3 250 R4 250	250
UNITS	total ug	total ug	total ug	total ug	total ug	total ug	ug/g	ug/ml	ug/ml	ug/ml	ug/ml
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12700	<0.635	<0.635	<0.635	<0.635
RDX	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9800	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20900	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5900	<0.295	<0.295	<0.295	<0.295
NB	16.9*	19.6*	25.4*	<4.20	<4.20	<4.20	<4200	<0.210	<0.210	<0.210	<0.210
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50000	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	554000	<0.960	<0.960	<0.960	<0.960
2,6-DNT	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4000	<0.200	<0.200	<0.200	<0.200
2,4-DNT	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4200	<0.210	<0.210	<0.210	<0.210
QA/QC DATE	9/14	9/14	9/14	9/14	9/14	9/14	9/14	[illegible]	[illegible]	[illegible]	[illegible]

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 8908KL0024
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/14/89

Units RINSATE - ug/ml WIPE - total ug SOIL - ug/g
Analyst GAM
Reviewed

Notes: Data is corrected for dilution,

Comment: T-14 PRE TEST

MATRIX	R	R	R	R	R	R
LAB ID #	024-030	024-030	024-031	024-032	024-033	024-033
SAMPLE DESCRIPTION	SSR 1 SPIKE RINSE	SSR 1 SPIKE RINSE	SSR 2 SPIKE RINSE	SSR 1 SPIKE RINSE	SSR 2 SPIKE RINSE	SSR 2 SPIKE RINSE
Dilution	10	100	1000	1000	10	100
SAMPLE VOLUME (MLS)	250	250	30	30	250	250
UNITS	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
HMX	<6.35		<635	<635	<6.35	
RDX	<4.90		<490	<490	<4.90	
1,3,5-TNB	<10.5		<1050	<1050	<10.5	
1,3-DNB	<2.95		<295	<295	<2.95	
NB	<2.10		<210	<210	<2.10	
Tetryl	<25		<2500	<2500	<25	
2,4,6-TNT		805	18100	11600		1420
2,6-DNT	<2.00		<200	<200	<2.00	
2,4-DNT	0.670		<210	<210	1.78	
QA/QC DATE (1989)	8/14	8/14	8/14	8/14	8/14	8/14

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch QA/QC 8/14/89
Installation HAWTHORNE
Matrix: RINSATE, WIPE & SOIL

Analytical Lot
Date Prepared
Date Analyzed 8/14/89

Units RINSATE - ug/ml WIPE - total ug SOIL - ug/g
Analyst Gjm
Reviewed

Note: Data is corrected for dilution,

Comment:

MATRIX	R	R	W	W	S	S					
LAB ID #	BLANK	10x	BLANK	10x	BLANK	10x					
	RINSATE	RINSATE SPIKE	WIPE	WIPE SPIKE	SOIL	SOIL SPIKE					
Dilution	1	1	1	1	1	1					
UNITS	ug/ml	ug/ml	total ug	total ug	ug/g	ug/g					
HMX	<0.635	6.85 (108%)	<12.7	142 (112%)	<1.27	13.2 (104%)					
RDX	<0.490	4.81 (98%)	<9.80	99.3 (101%)	<0.980	9.15 (93%)					
1,3,5-TNB	<1.05	9.95 (96%)	<20.9	206 (97%)	<2.07	19.4 (93%)					
1,3-DNB	<0.295	2.77 (94%)	<5.90	57.3 (97%)	<0.590	5.39 (92%)					
NB	<0.210	2.02 (97%)	<4.20	42.2 (101%)	<0.420	4.19 (105%)					
Tetryl	<2.5	23.5 (94%)	<50.0	487 (97%)	<5.0	43.4 (87%)					
2,4,6-TNT	<0.960	8.25 (86%)	<19.2	172 (90%)	<1.92	15.9 (83%)					
2,6-DNT	<0.200	2.11 (106%)	<4.00	43.2 (108%)	<0.400	4.09 (103%)					
2,4-DNT	<0.210	1.95 (93%)	<4.20	40.2 (96%)	<0.420	3.91 (93%)					

Custody Transfer Record/Lab Work Request

WESTON 'D'

WESTON Analytics Use Only
8908HW026

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Salacka / N. Johnson
Client Contact/Phone: (215) 430-3117

Refrigerator#	
#/Type Container	VOA
Containers/Volume	
Preservative	ICE
ANALYSES REQUESTED	Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
001	T14 SSRI W1 upper	Wipe	8-18-89	X
002	W2			X
003	W3			X
004	W4			X
005	W5 lower			X
006	W6			X
007	W7			X
008	W8			X
009	T14 SM W1 ACN ~~W2 E~~	Wipe	8-18-89	X
010	T14 FC Walls W1 ACN	Wipe	8-18-89	X
011	T14 Wipe Blank W/A	Wipe	8-18-89	X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T14 Post Test Samples.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R.T. Salacka		8/18/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8908HW026

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Salacka / N. Johnson
Client Contact/Phone: (215) 430-3115

Refrigerator#				
#/Type Container			Amber	
Containers/Volume			500ml	
Preservative			cool	
ANALYSES REQUESTED			Explosives	

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
012	T14 CP Soil	Soil	8-18-89	X
013	T14 CP Field Blank Rinse	ACN	8-18-89	X
014	T14 PB1 R1	ACN	8-18-89	X
015	R2	↓	↓	X
016	R3	↓	↓	X
017	R4	↓	↓	X
018	T14 PB1 Field Blank R1	ACN	8-18-89	X
019	T14 SP1 R1	ACN	8-18-89	X
020	R2	↓	↓	X
021	R3	↓	↓	X
022	R4	↓	↓	X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T14 Post Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R. T. Salacka		8/18/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only: 8908HW026

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Salacki / N. Johnson
Client Contact/Phone: (215) 430-3117

Refrigerator#				
#/Type Container	Amber			
Containers/Volume	500 mL			
Preservative	Cool			
ANALYSES REQUESTED	Explosives			

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
023	T14 SHR1 R1	ACN	8-18-89	X
024	R2	↓	↓	X
025	R3			X
026	R4	↓	↓	X
027	T14 SHR Field Blank R1	ACN	8-18-89	X

Matrix: S - Soil; SE - Sediment; SO - Solid; W - Water; O - Oil; A - Air; DS - Drum Solids; DL - Drum Liquids; F - Fish; X - Other

Special Instructions: T14 Post Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R.T. Salacki		8/18/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:
2 Ambient or Chilled
NOTES:
3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:
4 Properly Preserved Y N
NOTES:
5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8905-HW-026-
Installation HAWTHORNE
Matrix: Rinsate, wipe, & Soil

Analytical Lot
Date Prepared
Date Analyzed 8/18/89

Units Rinsate ug/ml, wipe total ug, Soil ug/g
Analyst AIS
Reviewed

Note: Data is corrected for dilution.

Comment: T-14 Post test Samples

Matrix	W	W	W	W	W	W	W	W	W	W	W
LAB ID #	026-001	026-002	026-003	026-004	026-005	026-006	026-007	026-008	026-009	026-010	026-011
Sample Descript.	T14 SSRI W1 upper	T14 SSRI W2 upper	T14 SSRI W3 upper	T14 SSRI W4 upper	T14 SSRI W5 lower	T14 SSRI W6 lower	T14 SSRI W7 lower	T14 SSRI W8 lower	T14 3M W-ACN	T14 FC Walls W-ACN	T14 wipe blank W-ACN
Dilution	1	1	1	1	1	1	1	1	1	1	1
Sample Vol (ml)	—	—	—	—	—	—	—	—	—	—	—
Units	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX	38.3	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
1,3,5-TNB	27.2	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89
NB	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
2,4-DNT	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
QA/QC Date (10 am)	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908 HW 026-
Installation HAWTHORNE
Matrix: Rinsate, Wipe, & Soil

Analytical Lot
Date Prepared
Date Analyzed 8/18/89

Units Rinsate µg/ml, Wipe Total µg, Soil µg/g
Analyst AIS
Reviewed

Note: Data is corrected for dilution,

Comment: T-14 Post test Samples

Matrix	S	R	R	R	R	R	R	R	R	R	R
LAB ID #	026-012	026-013	026-014	026-015	026-016	026-017	026-018	026-019	026-020	026-021	026-022
Sample Descrip.	T14 CP Soil	T14 CP Field Blk	T14 PB1 R1	T14 PB1 R2	T14 PB1 R3	T14 PB1 R4	T14 PB1 Field Blk	T14 SP1 R1	T14 SP1 R2	T14 SP1 R3	T14 SP1 R4
Dilution	1	1	1	1	1	1	1	1	1	1	1
Sample Vol/wt	1 gm	250 ml	1000 ml	1000 ml	1000 ml	1000 ml	250 ml	1000 ml	1000 ml	1000 ml	1000 ml
Units	µg/g	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml
HMX	<1.27	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.98	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	<2.09	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.589	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.419	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Tetryl	<5.0	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<1.92	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
2,6-DNT	<0.4	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.42	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
QA/QC Date (1989)	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch: 8408 HW 026-
Installation: HAWTHORNE
Matrix: Rinsate, Wipe, & Soil

Analytical Lot:
Date Prepared:
Date Analyzed: 8/18/88

Units: Rinsate µg/ml, wipe-Total µg, soil µg/g
Analyst: ALS
Reviewed:

Note: Data is corrected for dilution,

Comment: T14 Post Test Samples ?

MATRIX	R	R	R	R	R						
LAB ID #	026-023	026-024	026-025	026-026	026-027						
Sample Description	T14 SHRI R1	T14 SHRI R2	T14 SHRI R3	T14 SHRI R4	T14 SHR Field Blk						
Dilution	1	1	1	1	1						
Sample vol/wt	300 ml	300 ml	300 ml	300 ml	250 ml						
Units	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml						
HMX	2.44	2.40	1.50	0.98	<0.635						
RDX	21.9	22.9	8.65	2.8	<0.49						
1,3,5-TNB	2.33	2.24	1.23	<1.05	<1.05						
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295						
NB	<0.210	<0.210	<0.210	<0.210	<0.210						
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5						
2,4,6-TNT	27.3	28.2	17.0	11.3	<0.96						
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20						
2,4-DNT	0.36	0.395	0.465	0.25	<0.21						
GA/QC Date (1988)	8/18	8/15	8/18	8/18	8/18						

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/2/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L398

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	POST T13 SM WS (ETOH	NITRATED ESTERS	5.0	u	UG	5.0
-002	POST T13FC CH WAL W2	NITRATED ESTERS	5.0	u	UG	5.0
-003	POST T13 WIPE BL W2	NITRATED ESTERS	7.5		UG	5.0
-004	PRE T14 SMW2 (ETOH)	NITRATED ESTERS	5.0	u	UG	5.0
-005	PRE T14 WIPE BL W2	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L39

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #. 8908L398

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T14 SM W2 ETOH (POST	NITRATED ESTERS	5.0	u	UG	5.0
-002	T14 FC WALLS W2 ETOH	NITRATED ESTERS	20.3		UG	5.0
-003	T14 POST WIPE BLANK	NITRATED ESTERS	5.0	u	UG	5.0
-004	T15 PRE SM W2 ETOH	NITRATED ESTERS	6.6		UG	5.0
-005	T15 PRE WIPE BLANK	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L4

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORT LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u	MG/L	
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u	MG/L	

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 3908L·

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RI
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	1(
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	[illegible]
		NITRATED ESTERS	48.8	2.5 u	50.0	[illegible]

TEST RUN 15
600°F/12 HOURS

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8908HV027

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: Salacka / N. Johnson
Client Contact/Phone: (215) 430-3117

Refrigerator#	
#/Type Container	VOA
Containers/Volume	
Preservative	Cool
ANALYSES REQUESTED	Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
001	T15 SSR1 W1 upper	Wipe	8-21-89	X
002	W2	↓	↓	X
003	W3 ↓	↓	↓	X
004	W4 ↓	↓	↓	X
005	W5 lower	↓	↓	X
006	W6 ↓	↓	↓	X
007	W7 ↓	↓	↓	X
008	W8 ↓	↓	↓	X
009	T15 SSR2 W1 upper	Wipe	8-21-89	X
010	W2 ↓	↓	↓	X
011	W3 ↓	↓	↓	X
012	W4 ↓	↓	↓	X
013	W5 lower	↓	↓	X
014	W6 ↓	↓	↓	X
015	W7 ↓	↓	↓	X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T15 PRE TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R.T. Salacka		8/21/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON Analytics Use Only
8908HW027

Custody Transfer Record/Lab Work Request

WESTON 2 of

Client USATHAMA /HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact Salacka / N. Johnson
Client Contact/Phone (215) 430-3117

		Refrigerator#			VOA	Amber
		#/Type Container			VOA	Amber
		Containers/Volume				40ml
		Preservative			Cool	cool
		ANALYSES REQUESTED			Explosives	
	WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected		
016	016	T15 SSR2 W8 Tower	Wipe	8-21-89	X	
	~~017~~					
017	018	T15 SM W1 ACN	Wipe	8-21-89	X	
018	019	T15 Wipe Blank W1 ACN	Wipe	8-21-89	X	
	~~020~~					
019	~~021~~	T15 CP Soil	Soil	8-21-89		X
	~~022~~					
020	020	T15 CP Field Blank Rinse	ACN	8-21-89		X
021	021	T15 PB1 R1	ACN	8-21-89		X
	022	R2	↓	↓		X
	023	R3				X
	024	R4				X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions:
T15 Pre Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	R. T. Salacka		8/21/89						

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON -8-

WESTON Analytics Use Only: 8908HW027

Client: USATHAMA / HWAAP
Work Order: 2281-05-02
Date Rec'd. ____ Date Due ____
RFW Contact: Salacka/N. Johnson
Client Contact/Phone: (215) 430-3117

Refrigerator#	
#/Type Container	Amber
Containers/Volume	500 ML
Preservative	cool
ANALYSES REQUESTED ➡	Explosives

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Explosives
025	T15 PB2 R1	ACN	8/21/89	X
026	R2	↓	↓	X
027	R3			X
028	R4			X
~~02~~				
029	T15 PB Field Blank R1	ACN	8/21/89	X
030	T15 AP1 Spike Rinsate	ACN	8/21/89	X
031	T15 AP2 Spike Rinsate	ACN	8/21/89	X
032	T15 SSR1 Spike Rinsate	ACN	8/21/89	X
033	T15 SSR2 Spike Rinsate	ACN	8/21/89	X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T15 Pre Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 5108-HW 027-
Installation [illegible]
Matrix: Rinsate, Wipe & Soil

Analytical Lot ______
Date Prepared ______
Date Analyzed 5/21/89, 5/23/89

Units Rinsate ug/ml, wipe-total ug, Soil ug/g
Analyst [illegible]
Reviewed ______

Notes: Data is corrected for dilution,

Comment: T15 Pre Test Samples

Matrix	W	W	W	W	W	W	W	S	R	R	R
LAB ID #	027-001→004	027-005→008	027-009→012	027-013→016	027-014→016	027-017	027-018	027-019	027-020	027-021→024	027-025→028
Sample Description	T15 SSR1 [illegible] upper	T15 SSR1 W5→W8 lower	T15 SSR2 W1→W4 upper	T15 SSR2 W5→W8 lower	T15 SSR2 W5→W8 lower	T15 SM W1 AEN	T15 Wipe blank W1 AEN	T15 CP Soil	T15 CP Field Blk Rinse	T15 PB1 R1→R4	T15 PB2 R1→R4
Dilution	1	1	1	1	10	1	1	100,000	1	1	1
Sample Vol/wt (mls)	—	—	—	—	—	—	—	1.00 gm	250 ml	#1 250 ml #2 250 ml #3 250 ml #4 250 ml	#1 250 ml #2 250 ml #3 250 ml #4 250 ml
Units	total ug	total ug	total ug	total ug	total ug	total ug	total ug	ug/g	ug/ml	ug/ml	ug/ml
HMX	<12.7	<12.7	26.5		596	<12.7	<12.7	<1270000	<0.635	<0.635	<0.635
RDX	<9.8	<9.8	41.6		2440	<9.8	<9.8	<980000	<0.49	<0.49	<0.49
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9		<20.9	<20.9	<2090000	<1.05	<1.05	<1.05
1,3-DNB	<5.59	<5.59	<5.59	<5.59		3.70 J	<5.59	559000	<0.295	<0.295	<0.295
NB	<4.19	<4.19	<4.19	<4.19		1.3 J	<4.19	<419000	<0.210	<0.210	<0.210
Tetryl	<50.0	<50.0	<50.0	<50.0		<50.0	<50.0	<5000000	<2.5	<2.5	<2.5
2,4,6-TNT	8.4 J	16.5 J	10.1 J	93.6		108	10.1 J	6570000	<0.96	0.43 J	<0.96
2,6-DNT	<4.0	<4.0	<4.0	<4.0		<4.0	<4.0	<400000	<0.20	<0.20	<0.20
2,4-DNT	<4.2	<4.2	24.9	3.3 J		19.6	<4.2	<420000	<0.21	<0.21	<0.21
CA/SC Date (1989)	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908-110-027-
Installation [illegible]
Matrix: Rinsate, wipe, & Soil

Analytical Lot
Date Prepared
Date Analyzed 5/31/89, 6/12/89

Units Rinsate µg/ml, wipe µg/wipe, Soil µg/g
Analyst ALS
Reviewed

Note: Data is corrected for dilution,

Comment: T15 Pre Test Samples

MATRIX	R	R	R	R	R	R	R	R	R	R	R
LAB ID #	027-030	027-030	027-030	027-031	027-031	027-032	027-032	027-032	027-033	027-033	027-033
Sample Description	T15 FB Field Blk R1	T15 AP1 Spike Rinsate	T15 AP1 Spike Rinsate	T15 AP2 Spike Rinsate	T15 AP2 Spike Rinsate	T15 SS01 Spike Rinsate	T15 SS01 Spike Rinsate	T15 SS01 Spike Rinsate	T15 SS02 Spike Rinsate	T15 SS02 Spike Rinsate	T15 SS02 Spike Rinsate
Dilution	1	1	100	10	100	1	1000	100	1000	100	1
Sample Vol/wt (ml)	250ml	250ml	250ml	250ml	250ml	30ml	30ml	30ml	30ml	30ml	30ml
Unit	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml
HMX	<0.035	<0.035		<6.35		<0.035					<0.035
RDX	<0.49	0.46 J		0.96 J		3.92 J					3.43 J
1,3,5-TNB	<1.05	0.13 J		<10.5		0.875 J					0.85 J
1,3-DNB	<0.295	<0.295		<2.95		0.295					0.37
NB	<0.210	<0.210		<2.10		<0.21					<0.21
Tetryl	<2.5	<2.5		<25		<2.5					<2.5
2,4,6-TNT	<0.96		1225		2050		10550		9000		
2,6-DNT	<0.20	<0.20		<2.0		<0.20					<0.20
2,4-DNT	<0.31	1.98		3.25				15.0		19.5	
Analysis Date	5/31	5/31	5/31	5/31	5/31	5/31	5/31	5/31	5/31	5/31	5/31

(1051)

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8908HW-029 -

Client: USATHAMA / HWAAP
Work Order: 2281-09-02
Date Rec'd. ____ Date Due ____
RFW Contact: N. Johnson, M. Mazelon
Client Contact/Phone ____

		Refrigerator#			
		#/Type Container		VOA	Semi Anal
		Containers/Volume			
		Preservative			
		ANALYSES REQUESTED		EXP	EXP
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected		
001	T15 SSR1 W1 Top Post Test	Water	8/27/89	X	
002	T15 SSR1 W2 Top			X	
003	T15 SSR1 W3 Top			X	
004	T15 SSR1 W4 Top			X	
005	T15 SSR1 W5 Bottom			X	
006	T15 SSR1 W6 Bottom			X	
007	T15 SSR1 W7 Bottom			X	
008	T15 SSR1 W8 Bottom			X	
009	T15 SSR Field Blank			X	
—					
010	T15 API R1 Post Test	AQ	8/27/89		X
011	T15 API R2				X
012	T15 API R3				X
013	T15 API R4				X
014	T15 AP Field Blank				X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T-15 POST TEST SAMPLES 600°F/12 hrs

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

EXP = EXPLOSIVES

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 89C8 HW-C29 —

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: N. Johnson, M. Mazelon
Client Contact/Phone ______

Refrigerator#				
#/Type Container				
Containers/Volume				
Preservative				
ANALYSES REQUESTED ➡				EXP

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	EXP
015	T-15 PB1R1 POST TEST	AQ	8/27/89	X
016	T15 PB1 R2 POST TEST			X
017	T15 PB1 R3 POST TEST			X
018	T15 PB1 R4 POST TEST			X
019	T15 PB FIELD BLANK POST TEST			X
—				
020	T15 SHR1 R1 POST TEST	AQ	8/27/89	X
021	T15 SHR1 R2 POST TEST			X
022	T15 SHR1 R3 POST TEST			X
023	T15 SHR1 R4 POST TEST			X
024	T15 SHR1 FIELD Blank POST			X
—				
025	T15 CP SOIL POST TEST	S	8/27/89	X
026	T15 CP FIELD Blank POST TEST	AQ	8/27/89	X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T-15 POST TEST SAMPLES 600°F / 12 hrs.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

WESTON

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact N. JOHNSON, M. MAZELON
Client Contact/Phone ______

Refrigerator#	
#/Type Container	NA
Containers/Volume	
Preservative	
ANALYSES REQUESTED ➡	EXP

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	EXP
027	T15 SM W1 POST TEST	WIPE	8/27/89	X
028	T15 SM Field Blank POST BT	WIPE	8/27/89	X
—				
029	T15 Flash Chmb Walls W1	WIPE	8/27/89	X
030	T15 Flash Chmb Walls Blank	WIPE	8/27/89	X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T-15 POST TEST SAMPLES
600°F/12 hrs

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

EXP = EXPLOSIVES

7-115

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch: Ga/Qc 5/27/89
Installation: HAWTHORNE
Matrix: Rinsate, Wipe, Soil

Analytical Lot:
Date Prepared:
Date Analyzed: 5/27/89

Units: Rinsate µg/ml, Wipe total µg, Soil µg/g
Analyst: AIS
Reviewed:

Note: Data is corrected for dilution,

Comment: T 15 Post test Samples / Qc.

MATRIX	R.	R	W	W.	S	S					
LAB ID #	Rinsate Blank	10x Rinsate	Wipe Blank	10x Wipe	Soil Blank	Soil ICV					
Dilution	1	1	1	1	1	1					
Units	µg/ml	µg/ml	total µg	total µg	µg/g	µg/g					
HMX	<0.635	6.25 98.2%	<12.7	127 100%	<1.27	12.07 95.0%					
RDX	<0.49	4.34 88.6%	<9.8	88.5 90.3%	<0.98	8.14 83.1%					
1,3,5-TNB	<1.05	8.95 85.6%	<20.9	184 88.0%	<2.09	18.2 87.3%					
1,3-DNB	<0.295	2.54 87.0%	<5.89	52.6 89.2%	<0.589	5.21 88.5%					
NB	<0.210	1.54 87.6	<4.19	38.0 90.8%	<0.419	3.76 89.7%					
Tetryl	<2.5	21.4 85.3%	<50.0	443 88.6%	<5.0	48.2 96.4%					
2,4,6-TNT	<0.96	7.5 78.2%	<19.2	157 81.8%	<1.92	15.4 80.8%					
2,6-DNT	<0.20	1.82 90.8%	<4.0	37.5 93.8%	<0.40	3.69 92.3%					
2,4-DNT	<0.21	1.67 79.6%	<4.2	34.7 82.6%	<0.42	3.37 80.1%					

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 5908-HW-029-
Installation HAWTHORNE
Matrix: Rinsate, wipe, Soil

Analytical Lot
Date Prepared
Date Analyzed 8/27/89, 8/29/89

Units Rinsate μg/ml, wipe total μg, Soil μg/g.
Analyst AIS
Reviewed

Note: Data is corrected for dilution,

Comment: TIS Perf test Samples.

MATRIX	W	W	W	W	W	W	W	W	W	R	R
LAB ID #	029-001	029-002	029-003	029-004	029-005	029-006	029-007	029-008	029-009	029-010	029-011
Sample Description	TIS SSRI W1 TOP	TIS SSRI W2 Top	TIS SSRI W3 TOP	TIS SSRI W4 TOP	TIS SSRI W5 Bot	TIS SSRI W6 Bot	TIS SSRI W7 Bott	TIS SSRI W8 Bot	TIS SSR Field Blk	TIS API R1	TIS API R2
Dilution	1	1	1	1	1	1	1	1	1	1	1
Sample Vol./wt (mls)	—	--	—	—	—	—	—	--	—	1000 ml	1000 ml
Units	total μg	total μg	total μg	total μg	total μg	total μg	total μg	total μg	total μg	μg/ml	μg/ml
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<0.635	<0.635
RDX	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<0.49	<0.49
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<1.05	<1.05
1,3-DNB	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<0.295	<0.295
NB	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<0.210	<0.210
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<2.5	<2.5
2,4,6-TNT	4.8 J	5.5 J	1.4 J	1.8 J	6.6 J	2.5 J	2.9 J	2.3 J	2.3 J	<0.96	<0.96
2,6-DNT	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<0.20	<0.20
2,4-DNT	1.3J	1.2	<4.2	<4.2	1.3J	1.4 J	1.4 J	1.4 J	<4.2	<0.21	<0.21
Ext/Anal. Date (1989)	8/27	8/27	8/27	8/27	8/27	8/27	8/27	8/27	8/27	8/27	8/27

Should this be a J value

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 890P HW-029-
Installation HAWTHORNE
Matrix: Rinsate, wipe, soil

Analytical Lot
Date Prepared
Date Analyzed 5/27/89, 8/25/89

Units Rinsate µg/ml, wipe-total µg, Soil µg/g
Analyst
Reviewed

Note: Data is corrected for dilution.

Comment: TIS Post Test Samples

MATRIX	R	R	R	R	R	R	R	R	R	R	R
LAB ID #	029-012	029-013	029-014	029-015	029 016	029 017	029 018	029-019	029 020	029 021	029 022
Sample Description	TIS API R3	TIS-API R4	TIS-AP Field Blk	TIS PBI R1	TIS PBI R2	TIS PB R3	TIS PBI R4	TIS PB Field Blk	TIS SHRI R1	TIS SHRI R2	TIS SHRI R3
Dilution	1	1	1	1	1	1	1	1	1	1	1
Sample Vol/Wt (ml)	1000 ml	1000 ml	250 ml	1000 ml	1000 ml	1000 ml	1000 ml	250 ml	300 ml	300 ml	300 ml
Units	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml
HMX	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
QA/QC Date 1989	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 5908-11c-029
Installation HAWTHORNE
Matrix: Rinsate, wipe, Soil

Analytical Lot
Date Prepared
Date Analyzed 8/27/89, 8/28/89

Units Rinsate ug/ml, wipe total ug, Soil ug/g
Analyst AIS
Reviewed

Note: Data is corrected for dilution,

Comment: TIS Post test Samples

MATRIX	R	R	S	R	W	W	W	W			
LAB ID #	029-023	029-024	029-025	029-026	029 027	029 028	029 029	029-030			
Sample Description	TIS SHRI RV	TIS SHRI Field Blk	TIS CP Soil	TIS Field Blk	TIS SM W1	TIS SM Field Blk	TIS Flash Chamb Walls W	TIS Flash Chamb Walls Blank			
Dilution	1	1	1	1	1	1	1	1			
Sample Vol. (mls)/wt	300 ml	300 ml	1 gm	250 ml	—	—	—	—			
Units	ug/ml	ug/ml	ug/gm	ug/ml	total ug	total ug	total ug	total ug			
HMX	<0.635	<0.635	<1.27	<0.635	<12.7	<12.7	<12.7	<12.7			
RDX	<0.49	<0.49	<0.98	<0.49	<9.8	<9.8	<9.8	<9.8			
1,3,5-TNB	<1.05	<1.05	<2.09	<1.05	<20.9	<20.9	<20.9	<20.9			
1,3-DNB	<0.295	<0.295	<0.589	<0.295	<5.89	<5.89	<5.89	<5.89			
NB	<0.210	<0.210	<0.419	<0.210	<4.19	<50.0	<50.0	<50.0			
Tetryl	<2.5	<2.5	<5.0	<2.5	<50.0	<50.0	<50.0	<50.0			
2,4,6-TNT	<0.96	<0.96	<1.92	<0.96	1.3 J	1.2 J	1.9 J	5.0 J			
2,6-DNT	<0.20	<0.20	<0.40	<0.20	<4.0	<4.0	<4.0	<4.0			
2,4-DNT	<0.21	<0.21	<0.42	<0.21	1.7 J	1.4 J	1.6 J	1.5 J			
SA/QC Date (1989)	8/27	8/27	8/27	8/27	8/27	8/27	8/27	8/27			

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D. 2/21/90
Laboratory Manager Date
Lionville Analytical Laboratory

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T14 SM W2 ETOH (POST	NITRATED ESTERS	5.0	u	UG	5.
-002	T14 FC WALLS W2 ETOH	NITRATED ESTERS	20.3		UG	5.
-003	T14 POST WIPE BLANK	NITRATED ESTERS	5.0	u	UG	5.
-004	T15 PRE SM W2 ETOH	NITRATED ESTERS	6.6		UG	5.
-005	T15 PRE WIPE BLANK	NITRATED ESTERS	5.0	u	UG	5.

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L46

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	48.8	2.5 u	50.0	97.6

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/21/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L53

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T15SMW2 POST TEST	NITRATED ESTERS	5.0	u	UG	5
-002	T15SM FB POST TEST	NITRATED ESTERS	5.0	u	UG	5
-003	T15 FLSH CHMB WALLW2	NITRATED ESTERS	7.9		UG	5.
-004	T15 FLSH CHMB WALLBL	NITRATED ESTERS	5.0	u	UG	5.

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/21/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L534

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/21/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L5[illegible]

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	10[illegible]
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	9[illegible]
		NITRATED ESTERS	48.8	2.5 u	50.0	9[illegible]

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/21/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L534

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

TEST RUN 16
600°F/6 HOURS

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908HW-028

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact MRedon, Johnson
Client Contact/Phone ______

Refrigerator#													
#/Type Container					1 oA								
Containers/Volume													
Preservative													
ANALYSES REQUESTED					Expl.								
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected										
001	T16 SSR1 W1 TOP PRE	Wipe	8/24/89	X									
002	T16 SSR1 W2 TOP			X									
003	T16 SSR1 W3 TOP			X									
004	T16 SSR1 W4 TOP			X									
005	T16 SSR1 W5 BOTTOM PRE.	WIPE	8/24/89	X									
006	T16 SSR1 W6 BOTTOM PRE			X									
007	T16 SSR1 W7 BOTTOM PRE			X									
008	T16 SSR1 W8 BOTTOM PRE			X									
009	T16 SSR2 W1 TOP PRE	WIPE	8/24/89	X									
010	T16 SSR2 W2			X									
011	T16 SSR2 W3			X									
012	T16 SSR2 W4			X									

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T-16 PRE TEST SAMPLES
600°F/6 hr.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

Client: CSATHAMA IHWAAP
Work Order: 228-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: MAZELIN, JOHNSON
Client Contact/Phone ______

Refrigerator#									
#/Type Container	VOA								
Containers/Volume									
Preservative									
ANALYSES REQUESTED →	EXPLOSIVES								

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	EXPLOSIVES								
013	T16 SSR2 W5 BOTT PRE	WIPE	8/24/88	X								
014	T16 SSR2 W6 BOTT PRE	WIPE	↓	X								
015	T16 SSR2 W7 BOTT PRE	WIPE	↓	X								
016	T16 SSR2 W8 BOTT PRE	WIPE	↓	X								
017	T16 SSR FIELD BLANK	WIPE	8/24/88	X								

Matrix: S - Soil; SE - Sediment; SO - Solid; W - Water; O - Oil; A - Air; DS - Drum Solids; DL - Drum Liquids; F - Fish; X - Other

Special Instructions: T-16 PRE TEST SAMPLES
600°F/6 hrs

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact N. Johnson
Client Contact/Phone ______

				Refrigerator#									
				#/Type Container	VOA								
				Containers/Volume									
				Preservative									
				ANALYSES REQUESTED →	Exp								
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected										
018	T16SMW1 PRETEST	WIPE	8/24/89		X								
019	T16SMWIPE BLANK PRE.	WIPE	8/24/89		X								

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T-16 PRE TEST SAMPLES 600°F/6 hr.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only

Client USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact Mareloa, Johnson
Client Contact/Phone ______

Refrigerator#	
#/Type Container	
Containers/Volume	
Preservative	
ANALYSES REQUESTED ➡	Exp

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Exp
020	T16 PB1 R1 PRE TEST	AQ	8/24/89	X
021	T16 PB1 R2 PRE "	AQ		X
022	T16 PB1 R3 PRE "	AQ		X
023	T16 PB1 R4 PRE "	AQ		X
~~024~~				
024	T16 PB2 R1 PRE TEST	AQ	8/24/89	X
025	T16 PB2 R2 PRE TEST	AQ		X
026	T16 PB2 R3 PRE TEST	AQ		X
027	T16 PB2 R4 PRE TEST	AQ		X
028	T16 PB FIELD BLANK PRETEST	AQ	8/24/89	X
029	T16 CP S1 PRE TEST	S	8/24/89	X
030	T16 CP FIELD BLANK PRE	AQ	8/24/89	X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T-16 PRE TEST SAMPLES
600°F/6hrs.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908 HW-028-

Client - USATHAMA / HWAAP
Work Order 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact N. Johnson, M. Mazzeon
Client Contact/Phone ______

		Refrigerator#										
		#/Type Container	500 Amber									
		Containers/Volume										
		Preservative										
		ANALYSES REQUESTED ⇨	Exp									
WA Use Only Lab ID	Client ID/Description	Matrix / Date Collected										
031	T16 SPIKE APPLICATOR RINSE FOR SSR 1	AQ 8/25/89	X									
032	T16 SPIKE APPLICATOR RINSE FOR SSR 2	AQ 8/25/89	X									

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: PRE T16 SPIKE APPLICATOR Rinse.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

EXP = EXPLOSIVES

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch QA/QC 8/25/89
Installation HAWTHORNE
Matrix: Rinsate, Wipe & Soil

Analytical Lot
Date Prepared
Date Analyzed 8/25/89

Units Rinsate- ug/ml, wipe- total ug, soil ug/g
Analyst AIS
Reviewed

Note: Data is corrected for dilution,

Comment: TIG Pre Test QA/QC

Matrix	R	R	W	W	S	S					
LAB ID #	Rinsate Blank	10x Rinsate	Wipe Blank	10x Wipe	Soil Blank	10x Soil					
Dilution	1	1	1	1	1	1					
Units	ug/ml	ug/ml	Total ug	Total ug	ug/g	ug/gm					
HMX	<0.635	6.55 103	<12.7	127 99.9%	<1.27	12.5 98.4%					
RDX	<0.49	4.56 93%	<9.8	88.7 98.6	<0.98	8.42 96.6%					
1,3,5-TNB	<1.05	9.6 91.4%	<20.9	186 89.0%	<2.09	19.5 93.1%					
1,3-DNB	<0.295	2.71 92.6%	<5.89	52.0 96%	<0.581	5.52 93.7%					
NB	<0.210	2.03 96.8%	<4.19	39.7 94.7%	<0.419	4.11 98.1%					
Tetryl	<2.5	22.2 88.6%	<50.0	430 85.9%	<5.0	43.6 87.1%					
2,4,6-TNT	<0.96	7.65 79.8%	<19.2	156 81.4%	<1.92	15.5 80.6					
2,6-DNT	<0.20	2.00 100%	<4.0	386 96.5%	<0.40	4.03 101%					
2,4-DNT	<0.21	1.90 90.3%	<4.2	371 88.2%	<0.42	3.81 90.8%					

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908-HW-028-
Installation HAWTHORNE
Matrix: Rinsate, wipe, & Soil

Analytical Lot
Date Prepared
Date Analyzed 8/25/89, 8/26/89

Units Rinsate-ug/ml, wipe-total ug, Soil ug/g
Analyst AJS
Reviewed

Note: Data is corrected for dilution,

Comment: TIG Pre-Test Samples

MATRIX	W	W	W	W	W	W	W	W	R	R	
LAB ID #	028-001→004	028-005→008	028 009→012	028 013→016	028 013-016	028 017	028 015	028 019	028 020→023	028 024→027	
Sample Description	TIG SSR1 W1→W4	TIG SSR1 W5→W8	TIG SSR2 W1→W4	TIG SSR2 W5→W8	TIG SSR2 W5→W8	TIG SSR Field Blk	TIG SM W1	TIG SM wipe Blk	TIG PB1 R1→R4	TIG PB2 R1→R4	
Dilution	1	1	1	1	10	1	1	1	1	1	
Sample Vol:(ml)/wt	—	—	—	.	—	—	—	—	R1-250ml R2-250 R3-238 R4-238	R1-250 R2-250 R3-250 R4-250	
Units	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	ug/ml	ug/ml	
HMX	<12.7	38.4	<12.7		3787	<12.7	<12.7	<12.7	<0.635	<0.635	
RDX	<9.8	240	<9.8		1610	<9.8	3.2 J	<9.8	<0.49	<0.49	
1,3,5-TNB	6.1 J	17.6 J	<20.9	<20.9		<20.9	6.2 J	<20.9	<1.05	<1.05	
1,3-DNB	<5.89	3.1 J	<5.89	<5.89		<5.89	4.6 J	<5.89	<0.295	<0.295	
NB	<4.19	19.4	<4.19	4.2		<4.19	<4.19	<4.19	<0.210	<0.210	
Tetryl	<50.0	<50	<50.0	<50.0		<50.0	<50.0	<50.0	<2.5	<2.5	
2,4,6-TNT	4.7 J	549	0.9 J	92.7		1.2 J	55.2	1.3 J	<0.96	<0.96	
2,6-DNT	<4.0	<4.0	<4.0	<4.0		<4.0	<4.0	<4.0	<0.20	<0.20	
2,4-DNT	4.2	5.0	3.8 J	2.7 J		1.8 J	30.6	1.9 J	<0.21	<0.21	
Ext/Anc (date) (1989)	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908-HW-028-
Installation HAWTHORNE
Matrix: Rinsate, Wipe, Soil

Analytical Lot
Date Prepared
Date Analyzed 8/25/89, 8/26/89

Units Rinsate-ug/ml, wipe-total ug, soil ug/gm
Analyst AJS
Reviewed

Note: Data is corrected for dilution,

Comment: T-16 - Pre Test samples

MATRIX	R	S	R	R	R	R	R				
LAB ID #	028-028	028-029	028-030	028 681	028 S1	028-032	028-032				
Sample Description	T16 PB Field Blk	T16 CP S1	T16 CP Field Blk	T16 SSR1 Spike	T16 SSR1 Spike	T16 SSR2 Spike	T16 SSR2 Spike				
Dilution	1	10000	1	100	1000	100	1000				
Sample Vol./wt	250 ml	1 gm	250 ml	30	30	30	30				
Units	ug/ml	ug/gm	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml				
HMX	<0.635	<12700	<0.635	<63.5		<63.5					
RDX	<0.49	<9800	<0.49	<49		<49					
1,3,5-TNB	<1.05	<20900	<1.05	<105		<105					
1,3-DNB	<0.295	<5890	<0.295	<29.5		<29.5					
NB	<0.210	<4190	<0.210	<21		<21.0					
Tetryl	<2.5	<50000	<2.50	<250		<250					
2,4,6-TNT	<0.96	195000	<0.96		4985		5500				
2,6-DNT	<0.20	<4000	<0.20	<20.0		<20.0					
2,4-DNT	<0.21	<4200	<.21	15.5 J		20.0					
QA/QC Date	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908HW030-

Client USATHAMA / HWAAP
Work Order 2281-64-02
Date Rec'd. ______ Date Due ______
RFW Contact N. Johnson / M. Mazelon
Client Contact/Phone 215-430-3117

		Refrigerator#										
		#/Type Container										
		Containers/Volume										
		Preservative										
		ANALYSES REQUESTED		Explos.								
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected									
001	Powder Box T16 PB1 R1 Post	ACN	7/31/89	X								
002	R2			X								
003	R3			X								
004	R4			X								
005	Field Blank			X								
006	Heated Riser T16 SHR R1 Post			X								
007	R2			X								
008	R3			X								
009	R4			X								
010	Field Blank			X								
011	Support Rack T16 SSR/W1 Post	Wipe		X								
012	W2			X								
013	W3			X								
014	W4			X								
015	W5			X								

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions:
T16 POST-TEST 1 6 HRS. @ 600°F

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Sample Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8908-HW-030-

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ________ Date Due ________
RFW Contact: N. Johnson / M. Mazelon
Client Contact/Phone: 215-430-3117

		Refrigerator#										
		#/Type Container										
		Containers/Volume										
		Preservative										
		ANALYSES REQUESTED ➡	EXPL									
WA Use Only Lab ID	Client ID Description	Matrix	Date Collected									
016	Support Rack T16 SSR W6 Post	Wipe	9/21/89	X								
017	W7			X								
018	W8			X								
019	Field Blank			X								
020	Clay Pipe T16 CP Soil Post	Soil		X								
021	" " " " Field Blank	ACN		X								
022	Ship Mine T16 SM W1 Post	Wipe		X								
023	" " " " Field Blank	"		X								
024	Heated Valve T16 SHV R1 Post	ACN		X								
025	R2			X								
026	R3			X								
027	R4			X								
028	Field Blank			X								
029	Chamber Walls T16 W1 Post	Wipe		X								
030	" " Field Blank			X								

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T16 POST-TEST 6 HRS. @ 600° F

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch QA/QC 9/1/89
Installation HAWTHORNE
Matrix:

Analytical Lot
Date Prepared
Date Analyzed 8/31/89

Units Rinsate µg/ml, wipe total µg, soil µg/gram
Analyst -AIS
Reviewed

Note: Data is corrected for dilution,

Comment: T16-Post Test 600°F @ 6hr / QC Samples

MATRIX	R	R	W	W	S	S					
LAB ID #	Rinsate Blank	10x Rinsate	Wipe Blank	10x Wipe	Soil Blank	10x Soil					
Dilution	1	1	1	1	1	1					
Units	µg/ml	µg/ml	Total µg	Total µg	µg/g	µg/g					
HMX	<0.635	6.55 103%	<12.7	132 104%	<1.27	12.2 96.3%					
RDX	<0.49	4.96 101%	<9.8	99.8 102%	<0.98	8.97 91.2%					
1,3,5-TNB	<1.05	10.5 99.8%	<20.9	211 101%	<2.09	20.8 99.7%					
1,3-DNB	<0.295	2.89 97.9%	<5.90	57.7 98%	<0.59	5.71 97.0%					
NB	<0.210	2.0 95%	<4.20	40.6 96.8%	<0.42	3.87 92.4%					
Tetryl	<2.5	26 104%	<50.0	505 101%	<5.0	49.2 98.4%					
2,4,6-TNT	<0.96	10.3 107%	<19.2	206 107%	<1.92	21.8 113%					
2,6-DNT	<0.20	1.87 93.2%	<4.0	37.9 94.7%	<0.40	3.62 90.6%					
2,4-DNT	<0.21	1.94 92.4%	<4.20	40.1 95.4%	<0.42	3.87 92.2%					

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908HW-030
Installation HAWTHORNE
Matrix: Rinsate, Wipe, Soil

Analytical Lot ______
Date Prepared ______
Date Analyzed 8/31/89, 9/1/89

Units Rinsate ug/ml, wipe total ug, soil ug/g
Analyst AJS
Reviewed ______

Note: Data is corrected for dilution.

Comment: "T16- Post Test 600°F @ 6 hour."

Matrix	R	R	R	R	R	R	R	R	R	R	W
LAB ID #	030 001	030 002	030 003	030 004	030 005	030 006	030 007	030 008	030 009	030 010	030 011
Sample Description	PB TIG PB1-R1	PB TIG PB1-R2	PB-TIG PB1-R3	PB-TIG PB1-R4	PB-TIG PB Field Blk	HR TIG SHR1 R1	HR TIG SHR1 R2	HR TIG SHR1 R3	HR TIG SHR1 R4	HR TIG SHR1 Field Blk	SR TIG SSR1 W1
Dilution	1	1	1	1	1	1	1	1	1	1	1
Sample Vol/wt (mL)	1000	1000	1000	1000	250	1000	1000	1000	1000	250	—
Units	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	Total ug
HMX	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<12.7
RDX	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<9.8
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<20.9
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<5.90
NB	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<4.20
Tetryl	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<50
2,4,6-TNT	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	12.1 J
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<4.0
2,4-DNT	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<4.2
Analysis Date (1989)	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908HW-030
Installation HAWTHORNE
Matrix: Rinsate, wipe, Soil

Analytical Lot
Date Prepared
Date Analyzed 8/31/89, 9/1/89

Units Rinsate ug/ml, Wipe total ug, Soil ug/g
Analyst AIS
Reviewed

Note: Data is corrected for dilution,

Comment: TIG- Post Test Sampler 600F @ 6 hours

MATRIX	W	W	W	W	W	W	W	W	S	R	W
LAB ID #	020-012	020-013	030-014	030-015	030-016	030-017	030-018	030-019	030-020	030-021	030-022
Sample Description	SR TIG SSRI W2	SR TIG SSRI W3	SR TIG SSRI W4	SR TIG SSRI W5	SR TIG SSRI W6	SR TIG SSRI W7	SR TIG SSRI W8	SR TIG SSRI Field Blk	CP TIG CP Soil	CP TIG CP Field Blk	SM TIG SM W1
Dilution	1	1	1	1	1	1	1	1	1	1	1
Sample Vol: wt mls	—	—	—	—	—	—	—	—	1 gm	250	—
Units	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	ug/g	ug/ml	Total ug
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<1.27	<0.635	<12.7
RDX	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<0.98	<0.49	<9.8
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<2.09	<1.05	<20.9
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<0.59	<0.295	<0.59
NB	<4.20	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<0.42	<0.210	<4.2
Tetryl	<50.0	<50	<50	<50	<50	<50	<50	<50	<5.0	<25	<50
2,4,6-TNT	8.7 J	10.3 J	8.6 J	8.7 J	13.2 J	10.3 J	10.2 J	12.3 J	<1.92	<0.96	7.6 J
2,6-DNT	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<0.40	<0.20	<4.0
2,4-DNT	<4.2	<4.2	1.0 J	<4.2	<4.2	1.0 J	<4.2	1.0 J	<0.42	<0.21	2.3 J
QA/QC Date (1989)	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908-HW-030
Installation HAWTHORNE
Matrix: Rinsate, wipe, soil

Analytical Lot
Date Prepared
Date Analyzed 8/31/89, 9/1/89

Units Rinsate ug/ml, wipe total ug, Soil ug/g.
Analyst AIS
Reviewed

Note: Data is corrected for dilution,

Comment: TIG.. Post Test Samples 600°F @ 6 hours

MATRIX	W	R	R	R	R	R	W	W			
LAB ID #	030-023	030-024	030-025	030-026	030-027	030-028	030-029	030-030			
Sample Description	SM TIG SM Field BK	HV TIG SHV1 R1	HV TIG SHV1 R2	HV TIG SHV1 R3	HV TIG SHV1 R4	HV TIG SHV1 Field BLK	CW TIG W1	CW TIG Field BLK			
Dilution	1	1	1	1	1	1	1	1			
Sample Vol/wt (mls)	—	1000	1000	1000	1000	250	—	--			
Units	Total ug	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	Total ug	Total ug			
HMX	<12.7	<0.635	<0.635	<0.635	<0.635	<0.635	<12.7	<12.7			
RDX	<9.8	<0.49	<0.49	<0.49	<0.49	<0.49	<9.8	<9.8			
1,3,5-TNB	<20.9	<1.05	<1.05	<1.05	<1.05	<1.05	<20.9	<20.9			
1,3-DNB	<5.90	<0.295	<0.295	<0.295	<0.295	<0.295	<5.90	<5.90			
NB	<4.20	<0.210	<0.210	<0.210	<0.210	<0.210	<4.20	<4.20			
Tetryl	<50.0	<2.50	<2.50	<2.50	<2.50	<2.50	<50.0	<50.0			
2,4,6-TNT	10.5 J	<0.96	<0.96	<0.96	<0.96	<0.96	14.8 J	10.8 J			
2,6-DNT	<4.0	<0.20	<0.20	<0.20	<0.20	<0.20	<4.0	<4.0			
2,4-DNT	1.2 J	<0.21	<0.21	<0.21	<0.21	<0.21	2.3 J	1.10 J			
Sample Date (1989)	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31			

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP SAMPLES RECEIVED: 09-02-89
RFW #: 8909L597 - RINSATES
W.O. #: 2281-08-02

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02 modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
BLK =	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS =	Designates sample spiked with target compound.
SSD =	Designates sample spiked with target compound in duplicate.
D =	Indicates duplicate analysis of a sample.
NS =	Not spiked.
DL =	Diluted below calibration range.
G =	Indicates elevated detection limit due to sample interference.
NR =	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than
> = Greater Than

Analysis Summary

Samples Collected: 08-31-89
Samples Prepared: 09-07-89
Samples Analyzed: 09-22-89

Cr [signature] 10-13-89
Carter Nulton, Ph.D. Date
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS

EXPLOSIVES IN RINSATE DATA SUMMARY

RFW Batch Number: 8909L597 CLIENT: USATHAMA HWAAP

Sample Information	Client ID :	T16SHV1 R1 DUP	T16SHR1 R1 DUP	T16PB1 R1 DUP	---	---
	RFW#:	001	002	003	BLANK	2XSS
	D.F.:	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 254	< 254	< 254	< 1.27	3.09(120%)
RDX		< 196	< 196	< 196	< 0.98	2.22(112%)
1,3,5-TNB		< 418	< 418	< 418	< 2.09	4.45(105%)
1,3-DNB		< 118	< 118	< 118	< 0.59	1.25(105%)
NITROBENZENE		< 84	< 84	< 84	< 0.42	0.84(99.2%)
TETRYL		< 1000	< 1000	< 1000	< 5.00	7.18(71.1%)
2,4,6-TNT		< 384	< 384	< 384	< 1.92	2.95(75.8%)
2,6-DNT		< 80	< 80	< 80	< 0.40	0.88(108%)
2,4-DNT		< 84	< 84	< 84	< 0.42	0.87(103%)

Sample Information	Client ID :	---	---
	RFW#:	10XSS	10XSSD
	D.F.:	1	1
	Units:	Total ug	Total ug
HMX		15.2(118%)	15.0(117%)
RDX		10.9(111%)	10.7(109%)
1,3,5-TNB		22.2(105%)	22.1(105%)
1,3-DNB		6.20(105%)	6.22(105%)
NITROBENZENE		4.17(98.9%)	4.22(100%)
TETRYL		49.3(97.7%)	47.7(94.4%)
2,4,6-TNT		17.9(92.7%)	17.1(88.4%)
2,6-DNT		4.28(106%)	4.41(109%)
2,4-DNT		4.16(98.3%)	4.31(102%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

2/2/90

Jack R. Tuschall, Ph.D. | Date
Laboratory Manager
Lionville Analytical Laboratory

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L524

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T16SMW2 PRE TEST	NITRATED ESTERS	5.0	u	UG	5.0
-002	T16SM WIPE BL PRTEST	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L52

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u	MG/L	2
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L524

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	48.8	2.5 u	50.0	97.6

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-IWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L5

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L595

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-019	T16SMW1POST	NITRATED ESTERS	5.0	u	UG	5.0
-020	T16SM FIELD BLANK	NITRATED ESTERS	5.0	u	UG	5.0
-021	T16 CHAMBER WELL W1	NITRATED ESTERS	5.0	u	UG	5.0
-022	T16 CHAMBER WELL BLA	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L59

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTI LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u	MG/L	2
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L595

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	48.8	2.5 u	50.0	97.6

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L59

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

July 1990
Revision: Final

TEST RUN 17
600°F/48 HOURS

1311R2

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8908-HEW031

Client: USATHAMA / HKWAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: N. JOHNSON / M. MAZELON
Client Contact/Phone: (215) 430-3117

		Refrigerator#											
		#/Type Container											
		Containers/Volume											
		Preservative											
		ANALYSES REQUESTED											
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected										
014	Aluminum pipe T17AP1 R1	ACN	8/30/89										
015	R2												
016	R3												
017	R4												
018	T17AP2 R1												
019	R2												
020	R3												
021	R4												
022	T17AP Field Blank												
~~023~~	Stl pipe (2)												
023 ~~024~~	T17 SP1 R1												
024 ~~025~~	R2												
025 ~~026~~	R3												
026 ~~027~~	R4												

AP
de
8/31/89

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions:

T17 Pre Test 600°F @ 48 hours.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908-HEW-031

Client USATHAMA/HWAAP
Work Order 2231-08-02
Date Rec'd. ______ Date Due ______
RFW Contact N. JOHNSON/M. MAZELON
Client Contact/Phone (215) 430 3117

Refrigerator#	
#/Type Container	
Containers/Volume	
Preservative	
ANALYSES REQUESTED ⇨	

	WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected
	027	Steel Pipe (2)	AEN	8/30/8
027	028	T17SP2 R1	↓	↓
028	029 Abe	R2	↓	↓
029	030 8/31/8	R3	↓	↓
030	031	R4	↓	↓
	031	T17 SP Field Blank	↓	↓

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions:

T17 Pre Test 600°F @ 48 hours.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/88

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8908 HEW-031

Client USATHAMA/HWAAP
Work Order 3281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact N. JOHNSON / M. MAZELON
Client Contact/Phone (215) 430 3117

Refrigerator#	
#/Type Container	
Containers/Volume	
Preservative	
ANALYSES REQUESTED ➔	

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected
	Steam Heated Risers	AeN	8/30/89
032	T17SHR1 R1		
033	R2		
034	R3		
035	R4		
036	T17SHR2 R1		
037	R2		
038	R3		
039	R4		
040	T17SHR Field Blank		
041	Steam heated Valves T17SHV R1		
042	R2		
043	R3		
044	R4		
045	T17 SHV Field Blank		

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T17 Pre Test 600F @ 48 hours.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8908-HO-031

Client: USATHAMA / HWAAP
Work Order: 2281-03-02
Date Rec'd. ______ Date Due ______
RFW Contact: N. Johnson, M. Mazelon
Client Contact/Phone ______

Refrigerator#				
#/Type Container				
Containers/Volume				
Preservative				
ANALYSES REQUESTED ➡				Exp

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Exp
046	T17 SHV2 R1 PRETEST	AQ	8/30/89	X
047	↓ ↓ R2 ↓ ↓	↓		X
048	R3			X
049	↓ ↓ R4 ↓ ↓	↓		X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: T17 PRETEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch: QA/QC 9/1/89
Installation: HAWTHORNE
Matrix: Rinsate

Analytical Lot:
Date Prepared:
Date Analyzed: 9/1/89

Units: Rinsate µg/ml
Analyst: AIS
Reviewed:

Note: Data is corrected for dilution.

Comment: T17 Pre Test Sample/QC @ 600°F for 48 hr.

MATRIX	R	R									
LAB ID #	Blank	10X Rinsate									
	Rinsate	Rinsate spike									
Dilution	1	1									
Units	µg/ml	µg/ml									
HMX	<0.635	6.55 103%									
RDX	<0.49	4.99 102%									
1,3,5-TNB	<1.05	10.8 103%									
1,3-DNB	<0.295	3.01 102%									
NB	<0.210	2.15 102%									
Tetryl	<2.5	26.4 106%									
2,4,6-TNT	<0.96	9.55 103%									
2,6-DNT	<0.20	2.04 103%									
2,4-DNT	<0.21	2.06 98%									

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908 401-031
Installation HAWTHORNE
Matrix: Rinsate

Analytical Lot
Date Prepared
Date Analyzed 9/1/89

Units Rinsate ug/ml
Analyst NC
Reviewed

Note: Data is corrected for dilution,

Comment: T17 Pre Test Samples 600°F @ 48 hours.

MATRIX	R	R	R	R	R	R	R	R	R	R	R
LAB ID #	031 001→004	031 005→008	031 007→012	031- -013	031 014→017	031 014→017	031 018→021	031 022	031 023→026	031 027-030	031- -031
Sample Description	PBT17 PB1-R1→R4	PBT17PB2 R1→R4	PBT17 PB3 R1→R4	PBT17PB Field Blk	APT17AP1 R1→R4	APT17AP1 R1→R4	APT17AP2 R1→R4	APT17AP Field Blk	SPT17SP1 R1→R4	SPT17SP2 R1→R4	SPT17SP Field Blk
Dilution	1	1	1	1	1	10	1	1	1	1	1
Sample Vol. (ml)	R1-250 R2-250 R3-250 R4-250	R1-250 R2-250 R3-250 R4-250	R1-250 R2-250 R3-250 R4-250	250 ml	R1-250 R2-250 R3-250 R4-250	R1-250 R2-250 R3-250 R4-250	R1-250 R2-250 R3-250 R4-250	250	R1-250 R2-250 R3-250 R4-250	R1-250 R2-250 R3-250 R4-250	250
Units	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
HMX	<0.635	<0.635	<0.635	<0.635	5.49		6.75	<0.635	<0.635	<0.635	<0.635
RDX	<0.49	0.10 J	0.11 J	<0.49		36.3	17.3	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05		<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295		<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.21	<0.21	<0.21	<0.21	<0.21		<0.21	<0.21	<0.21	<0.21	<0.21
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5		<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	0.11 J	<0.96	<0.96	<0.96	7.2		0.545 J	<0.96	<0.96	<0.96	<0.96
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.21	<0.21	<0.21	<0.21	<0.21		<0.21	<0.21	<0.21	<0.21	<0.21
QA/QC Date (1989)	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908-HW-031
Installation HAWTHORNE
Matrix: Rinsate

Analytical Lot
Date Prepared
Date Analyzed 9/1/89

Units Rinsate µg/ml
Analyst
Reviewed

Note: Data is corrected for dilution,

Comment: T17 Pre Test Sample 600°F @ 48 hours

MATRIX	R	R	R	R.	R	R.					
LAB ID #	031 032-035	031 036-039	031-040	031-041-044	031-045	031 046-049					
Sample Description	SHR T17 SHR R1→R4	SHR T17 SHR R1→R4	SHR T17 SHR Field Blk	SHV T17 SHV R1→R4	SHV T17 SHV Field Blk	T17 SHV R1→R4					
Dilution	1	1	1	1	1	1					
Sample Vol. (mls)	R1 → 300 mls R2 → 300 R3 → 300 R4 → 300	R1-300 R2-300 R3-300 R4-300	250	R1-250 R2-250 R3-250 R4-250	250	R1 250 R2 250 R3 250 R4 250					
Units	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml					
HMX	<0.635	0.30J	<0.635	0.10 J	<0.635	<0.635					
RDX	0.14J	2.71	<0.49	<0.49	<0.49	<0.49					
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05					
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295					
NB	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21					
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5					
2,4,6-TNT	<0.96	0.15J	<0.96	<0.96	<0.96	<0.96					
2,6-DNT	<0.20	<0.20	<0.20	<0	<0.20	<0.20					
2,4-DNT	<0.21	<0.21	<0.21	2.64	<0.21	1.77					
QA/QC Date (1989)	9/1	9/1	9/1	9/1	9/1	9/1					

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
RFW #: 8909L679 - WIPES
W.O. #: 2281-08-02

SAMPLES RECEIVED: 09-11-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to U.S.G.S. methodology for picric acid.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
BLK =	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS =	Designates sample spiked with target compounds at 10x detection limit.
BSD =	Designates sample spiked with target compound in duplicate.
D =	Indicates duplicate analysis of a sample.
NS =	Not spiked.
DL =	Diluted below calibration range.
G =	Indicates elevated detection limit due to sample interference.
NR =	Not reported.
NOTE:	Spikes have been reported as result (% recovery).
NOTE:	Samples have been analyzed for picric acid and results converted mathematically to ammonium picrate.
NOTE:	Spike recoveries for these analysis ranged from 18% to 38%. Reported detection limits take these low recoveries into account.

Data Qualifiers

$<$ = Less Than and $>$ = Greater Than

Analysis Summary

Samples Collected: 09-08-89
Samples Prepared: 09-13-89
Samples Analyzed: 09-29-89

Zhruk Kl ______________ 10-11-89
Carter Nulton, Ph.D. Date
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS
EXPLOSIVES IN WIPE SAMPLES

RFW Batch Number: 8909L679 CLIENT: USATHAMA-HWAAP

Sample Information							
	Client ID :	T17FC WALLS W1	T17FC WALLS BLK	---	---	---	---
	RFW#:	026	027	BLANK	BS 1	BS 2	BS 3
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
Ammonium Picrate..................		< 10	< 10	9.3(113%)	45(110%)	41(99%)	

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
RFW #: 8909L679 - WIPES
W.O. #: 2281-08-02

SAMPLES RECEIVED: 09-11-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to U.S.G.S. methodology for picric acid.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS	=	Designates sample spiked with target compounds at 10x detection limit.
BSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Samples have been analyzed for picric acid and results converted mathematically to ammonium picrate.

NOTE: Spike recoveries for these analysis ranged from 18% to 38%. Reported detection limits take these low recoveries into account.

Data Qualifiers

< = Less Than and > = Greater Than

Analysis Summary

Samples Collected: 09-08-89
Samples Prepared: 09-13-89
Samples Analyzed: 09-29-89

Carter Nulton, Ph.D. — 10-17-89
Date

Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS
EXPLOSIVES IN RINSATES DATA SUMMARY

RFW Batch Number: 8909L679 CLIENT: USATHAMA-HWAAP

Sample Information							
	Client ID :	T17PB1R1 POST TEST	T17PB1R2 POST TEST	T17PB1R3 POST TEST	T17PB1R4 POST TEST	T17PB FIELD BL	T17SHV1R 1PSTTEST
	RFW#:	001	002	003	004	005	006
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
Ammonium Picrate..................		< 10	< 10	< 10	< 10	< 10	< 10

Sample Information							
	Client ID :	T17SHV1R2 POST TEST	T17SHV1R3 POST TEST	T17SHV1R4 POST TEST	T17SHV FIELD BLK	T17SHR1R1 POST TEST	T17SHR1R 2PSTTEST
	RFW#:	007	008	009	010	011	012
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
Ammonium Picrate..................		< 10	< 10	< 10	< 10	< 10	< 10

Sample Information							
	Client ID :	T17SHR1R3 POST TEST	T17SHR1R4 POST TEST	T17SHR FIELD BLK	T17AP1 R1	T17AP1 R2	T17AP1 R3
	RFW#:	013	014	015	016	017	018
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
Ammonium Picrate..................		< 10	< 10	< 10	< 10	< 10	< 10

WESTON ANALYTICS
EXPLOSIVES IN RINSATES DATA SUMMARY

RFW Batch Number: 8909L679 CLIENT: USATHAMA-HWAAP

Sample Information							
	Client ID :	T17AP1 R4	T17AP FIELD BLK	T17SP1R1 POST TEST	T17SP1R2 POST TEST	T17SP1R3 POST TEST	T17SP1R4 POSTTEST
	RFW#:	019	020	021	022	023	024
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
Ammonium Picrate..................		< 10	< 10	< 10	< 10	< 10	< 10

Sample Information							
	Client ID :	T17SP FIELD BLK	--- 858	--- 858	--- 858	--- 858	--- 857
	RFW#:	025	BLANK	BS1	BS2	BS3	BLANK
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
Ammonium Picrate..................		< 10	< 10	2.4(30%)	7.3(18%)	10.4(25%)	< 10

Sample Information				
	Client ID :	--- 857	--- 857	--- 857
	RFW#:	BS1	BS2	BS3
	D.F.:	1	1	1
	Units:	Total ug	Total ug	Total ug
Ammonium Picrate..................		3.1(38%)	12.6(31%)	13.1(32%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP SAMPLES RECEIVED: 09-02-89
RFW #: 8909L595 - RINSATES
W.O. #: 2281-08-02

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02 modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
BLK =	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS =	Designates sample spiked with target compound.
BSD =	Designates sample spiked with target compound in duplicate.
D =	Indicates duplicate analysis of a sample.
NS =	Not spiked.
DL =	Diluted below calibration range.
G =	Indicates elevated detection limit due to sample interference.
NR =	Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Samples have been analyzed for picric acid and results converted mathematically to ammonium picrate.

NOTE: Spike recoveries for these analysis ranged from 18% to 29%. Reported detection limits take these low recoveries into account.

Data Qualifiers

< = Less Than and > = Greater Than

Analysis Summary

Samples Collected: 08-30-89
Samples Prepared: 09-06-89
Samples Analyzed: 09-29-89

for Zohrab Hamid 10-13-89
Carter Nulton, Ph.D. Date
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS
EXPLOSIVES IN RINSATES DATA SUMMARY

RFW Batch Number: 8909L595 CLIENT: USATHAMA-HWAAP

Sample Information	Client ID :	T17SHR1 WR	T17SHV1 WR1	---	---	---	---
	RFW#:	001	010	BLANK	BS 1	BS 2	BS 3
	D.F.:	1	100	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
Ammonium Picrate....................		< 10	25.1	< 10.0	1.5(18%)	12.1(29%)	12.0(29%)

TEST RUN 18
300°F/6 HOURS

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8909HW 032

Client: USATHAMA / HWAAP
Work Order: 2281-08-02
Date Rec'd. ______ Date Due ______
RFW Contact: N. Johnson / Mike Mazzella
Client Contact/Phone ______

Refrigerator#	
#/Type Container	500 AMBER
Volume	
Preservative	
ANALYSES REQUESTED →	EXP

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	EXP
001	T18PB1R1 PRETEST	AQ	9/6/89	X
002	R2	↓	↓	X
003	R3			X
004	R4			X
005	T18 PB Field Blank PRETEST			X
006	T18 PB2 R1 PRETEST			X
007	R2			X
008	R3	↓	↓	X
009	R4	AQ	9/6/89	X
~~010~~				
010 ~~011~~	T18 CP Soil PRETEST	S	9/6/89	X
011 ~~012~~	T18 CP Field Blank	AQ	9/6/89	X
~~013~~				
	ADE 9/6/89			

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
WI - Wipe
DS - Drum Solids
DL - Drum Liquids
F - Fish
L - EP/TCLP Leachate
X - Other

Special Instructions: T-18 PRETEST SAMPLES 500°F / 6hr

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-12/88

7-115

EXP = EXPLOSIVES

1 of 3

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8909 HEW-032

Client: USATHAMA / AEWAMP
Work Order: 2281-0B-02
Date Rec'd. ______ Date Due ______
RFW Contact: N. Johnson / M. McFarland
Client Contact/Phone ______

	Refrigerator#									
	#/Type Container	VOA								
	Volume									
	Preservative									
	ANALYSES REQUESTED →	Exp								

	WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Exp
012	013	TIBSSR1 W1 PRETEST	WE	9/6/89	X
013	014	W2	↓	↓	X
014	015	W3			X
015	016	W4			X
016	017	W5 Balloon			X
017	018	W6			X
018	019	W7			X
019	020	W8			X
020	021	TIBSSR Field Blank	WE	9/6/89	X

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
WI - Wipe
DS - Drum Solids
DL - Drum Liquids
F - Fish
L - EP/TCLP Leachate
X - Other

Special Instructions: T-18 PRE TEST SAMPLES 500°F / 16hr.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-12/88

EXP - EXPLOSIVES

7-115

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only: 8909 H&O 032

Client: USATHAMA / HWAAP
Work Order: 2281-03-02
Date Rec'd. ____ Date Due ____
RFW Contact: N. Johnson / M. Mazelon
Client Contact/Phone ____

				EXP
			Refrigerator#	
			#/Type Container	10A
			Volume	
			Preservative	
			ANALYSES REQUESTED →	EXP
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	
021 ~~022~~	T18SSR2 W1 TOP PRE-TEST	WIPE	9/6/89	X
022 ~~023~~	W2	↓	↓	X
023 ~~024~~	W3	↓	↓	X
024 ~~025~~	W4	↓	↓	X
025 ~~026~~	W5 BOTTOM	↓	↓	X
026 ~~027~~	W6	↓	↓	X
027 ~~028~~	W7	↓	↓	X
028 ~~029~~	W8	↓	↓	X

Matrix:
S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, WI - Wipe, DS - Drum Solids, DL - Drum Liquids, F - Fish, L - EP/TCLP Leachate, X - Other

Special Instructions: T-18 PRE-TEST SAMPLES 500°F/6hr.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:

4 Properly Preserved Y N
NOTES:

5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

EXP = EXPLOSIVES

HFW 21-21-001/A-12/88

7-115

323

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8909 HW-032
Installation HAWTHORNE
Matrix: Rinsate,

Analytical Lot
Date Prepared
Date Analyzed 9/6/89

Units Rinse µg/ml, Wipe total µg, Soil µg/g
Analyst AIS
Reviewed

Note: Data is corrected for dilution,

Comment: T-18 Pre Test Samples 500°F @ 6 hour !

MATRIX	R	R	R	S	S	R	W	W	W	W	W
LAB ID #	032 001→004	032 005	032 006→009	032-010	032 010	032 011	032 012→015	032 016→019	032 016→019	032 020	032 021→024
Sample Description	T18 R01 R1→R4	T18 R0 Field blk	T18 R01 R1→R4	T18 CP Soil	T18 CP Soil	T18 CP Field Blk	T18 SSK1 W1→W4	T18 SSK1 W5→W8	T18 SSK1 W5→W8	T18 SSK Field Blk	T18 SSK2 W1→W4
Dilution	1	1	1	10000	1000	1	1	1	10	1	1
Sample Vol/wt (mls)	R1-250 R2-250 R3-250 R4-250	250	R1 250 R2 250 R3 250 R4 250	1 gm	1 gm	250	—	—	—	—	
Units	µg/ml	µg/ml	µg/ml	µg/g	µg/g	µg/ml	Total µg	Total µg	Total µg	Total µg	Total µg
HMX	<0.635	<0.635	<0.635		<1270	<0.635	2.1 J	481		<12.7	<12.7
RDX	0.18 J	<0.49	<0.49		<980	<0.49	14.2		1830	2.0 J	3.5 J
1,3,5-TNB	<1.05	<1.05	<1.05		<2090	<1.05	<20.9	<20.9		<20.9	<20.9
1,3-DNB	<0.295	<0.295	<0.295		<590	<0.295	<5.90	<5.90		<5.90	<5.90
NB	<0.210	<0.210	<0.210		<420	<0.210	9.7 G	1.8 J		<4.2	65.7 G
Tetryl	<2.50	<2.50	<2.50		<5000	<2.50	<50.0	<50.0		<50.0	<50.0
2,4,6-TNT	<0.96	<0.96	<0.96		424001	<0.96	<19.2	216		<19.2	1.5 J
2,6-DNT	<0.20	<0.20	<0.20		<400	<0.20	<4.0	<4.0		<4.0	<4.0
2,4-DNT	<0.21	<0.21	<0.21		<420	<0.21	<4.20	<4.20		<4.20	<4.20
Ext/Ge Date	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6

WESTON ANALYTICS EXPLOSIVES **DATA SUMMARY**

RFW Batch 8909 HAO 032 Analytical Lot ____ Units Rinsate ug/ml, Wipe total ug, Soil ug/g
Installation Hawthorne Date Prepared ____ Analyst AIS
Matrix: Rinsate, Wipe, Soil Date Analyzed 9|6|89 Reviewed ____

Note: Data is corrected for dilution,

Comment: T-18 Pre Test Samples 500°F @ 6 hours

MATRIX	W										
LAB ID #	E32-005 #08										
Sample Description	TF55H2 WS-#08										
Dilution	1										
Sample Vol/wt	—										
Units	Total ug.										
HMX	<12.7										
RDX	<9.8										
1,3,5-TNB	<20.9										
1,3-DNB	<5.90										
NB	30.56										
Tetryl	<50.0										
2,4,6-TNT	<19.2										
2,6-DNT	<4.0										
2,4-DNT	<4.20										

QA/QC Date (1989) 9/6

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch QA/QC 9/6/89
Installation HAWTHORNE
Matrix: Rinsate, Wipe, Soil

Analytical Lot ______
Date Prepared ______
Date Analyzed 9/6/89

Units Rinsate µg/ml, Wipe Total µg, Soil µg/g
Analyst AS
Reviewed ______

Note: Data is corrected for dilution,

Comment: "T-18 Pre Test Samples 500°F @ 6 hours / QA/QC Set 1

MATRIX	R	R	W	W	S	S					
LAB ID #	Blank Rinsate	10X Rinsate	Blank Wipe	10X Wipe	Blank Soil	10X Soil					
Dilution	1	1	1	1	1	1					
Units	µg/ml	µg/ml	Total µg	Total µg	µg/g	µg/g					
HMX	<0.635	6.7 86%	<12.7	145 114%	<1.27	12.7 100%					
RDX	<0.49	5.1 104%	<9.8	110 113%	<0.98	9.21 94%					
1,3,5-TNB	<1.05	11.0 105%	<20.9	240 115%	<2.09	21.1 101%					
1,3-DNB	<0.295	3.04 103%	<5.90	65.8 112%	<0.59	5.70 96.8%					
NB	<0.210	2.13 102%	<4.20	42.9 102%	<0.42	3.70 88.4%					
Tetryl	<2.5	25.7 103%	<50.0	562 112%	<5.0	49.1 98.2%					
2,4,6-TNT	<0.96	9.75 102%	<19.2	214 111%	<1.92	18.1 94.3%					
2,6-DNT	<0.20	2.1 105%	<4.0	45.1 113%	<0.40	3.42 85.6%					
2,4-DNT	<0.21	2.19 104%	<4.20	47.1 112%	<0.42	3.66 55.7%					

WESTON Analytics Use Only

8909 HW 033

Custody Transfer Record/Lab Work Request

Client VSATHAMA/HWAAP

Work Order 2281-08-02

Date Rec'd. ______ Date Due ______

RFW Contact N. Johnson/M. MAZZIBA

Client Contact/Phone ______

Refrigerator#	
#/Type Container	VOA
Containers/Volume	
Preservative	
ANALYSES REQUESTED	EXP

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	EXP
001	TIBSM W1 PreTest	WIPE	9/7/89	X
002	TIBSM Field Blank	WIPE	9/7/89	X
003	TIBSSR1 SPIKE Rinsate	AQ	9/7/89	X
004	TIBSSR2 SPIKE Rinsate	AQ	9/7/89	X

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: T-18 PRE TEST SAMPLES 500°F/6hr.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:
2 Ambient or Chilled
NOTES:
3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:
4 Properly Preserved Y N
NOTES:
5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-5/83

EXP = EXPLOSIVES

7-115

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch QA/QC 9/7/89
Installation HAWTHORNE
Matrix: Rinsate, Wipe

Analytical Lot ______
Data Prepared ______
Date Analyzed 9/7/89

Units Rinsate ug/ml, wipe total ug
Analyst [illegible]
Reviewed ______

Note: Data is corrected for dilution, ²

Comment: T-18 Pre Test Samples QC 500°F @ 6 hours !

MATRIX	R	R	W	W							
LAB ID #	Blank Rinsate	10X Rinsate	Blank Wipe	10X Wipe							
Dilution	1	1	1	1							
Units	ug/ml	ug/ml	Total ug	Total ug							
HMX	<0.635	7.35 (116%)	<12.7	104 (81.5%)							
RDX	<0.49	5.35 (109%)	<9.8	75.0 (76.5%)							
1,3,5-TNB	<1.05	11.5 (110%)	<20.9	165 (78.9%)							
1,3-DNB	<0.295	3.11 (105%)	<5.90	44.0 (74.7)							
NB	<0.210	1.26 (61.6%)	<4.20	19.0 (45.3%)							
Tetryl	<2.50	25.1 (100%)	<50.0	356 (71.2%)							
2,4,6-TNT	<0.96	8.65 (90.4%)	<19.2	120 (62.5%)							
2,6-DNT	<0.20	2.18 (110%)	<4.0	30.2 (75.4%)							
2,4-DNT	<0.21	2.02 (96.0%)	<4.20	27.9 (66.5%)							

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8909 HW-033
Installation Hawthorne
Matrix: Rinsate, Wipe

Analytical Lot
Date Prepared
Date Analyzed 9/7/89

Units Rinsate µg/ml, wipe Total ug
Analyst ALS
Reviewed

Note: Data is corrected for dilution.

Comment: T-18 Pre Test Sample 500°F @ 6 hours'

MATRIX	W	W	W	W	R	R
LAB ID #	033 001	033 001	033 001	033 002	033 003	033 004
Sample Description						
Dilution	1	10	1000	1	100	100
Sample Vol. mls						
Units	Total ug	Total ug	Total ug	Total ug	ug/ml	ug/ml
HMX		4430 J		<12.7	<63.5	<63.5
RDX			29300 J	<5.7 J	<49.0	<49.0
1,3,5-TNB	30.5 J			<20.9	<105	<105
1,3-DNB	<5.90			<5.90	<29.5	<29.5
NB	21.1 J			<4.26	<21.0	<21.0
Tetryl	<50.0			<50.0	<250	<250
2,4,6-TNT			4920 J	<19.2	1500 J	3785 J
2,6-DNT	<4.0			<4.0	<20	<20
2,4-DNT	39.1 J			<4.2	7.0 J	8.0 J

OA/QC (1989) – 9/7 9/7 9/7 9/7 9/7 9/7
9/7/89

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP SAMPLES RECEIVED: 09-20-89
RFW #: 8909L304 - WIPES
W.O. #: 2231-08-02

EXPLOSIVES NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02. Explosives in Soil, modified for the analysis of wipe samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than
> = Greater Than

Analysis Summary

Samples Collected: 09-18-89
Samples Prepared: 09-22-89
Samples Analyzed: 09-22-89

for [signature] 10-13-89

Carter Nulton, Ph.D. Date
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS
EXPLOSIVES IN WIPE SAMPLES DATA SUMMARY

RFW Batch Number: 8909L804 CLIENT: USATHAMA-HWAAP Page: 1

Sample Information							
	Client ID :	T18FC WALLS W1	T18FC WALLS BL	T18SSR1 W1 TOP	T18SSR1 W2	T18SSR1 W3	T18SSR1 W4
	RFW#:	005	006	007	008	009	010
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 12.7	< 12.7	< 12.7	< 12.7	< 12.7	< 12.7
RDX		< 9.80	< 9.80	< 9.80	< 9.80	< 9.80	< 9.80
1,3,5-TNB		< 20.9	< 20.9	< 20.9	< 20.9	< 20.9	< 20.9
1,3-DNB		< 5.90	< 5.90	< 5.90	< 5.90	< 5.90	< 3.90
NITROBENZENE		< 4.20	< 4.20	< 23.8G	< 14.5G	< 6.72G	< 6.41G
TETRYL		< 50.0	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0
2,4,6-TNT		< 19.2	< 19.2	< 19.2	< 19.2	< 19.2	< 19.2
2,6-DNT		< 4.00	< 4.00	< 4.00	< 4.00	< 4.00	< 4.00
2,4-DNT		< 4.20	< 4.20	< 4.20	< 4.20	< 4.20	< 4.20

Sample Information							
	Client ID :	T18SSR1 W5 BOTTOM	T18SSR1 W6	T18SSR1 W7	T18SSR1 W8	T18SSR FIELD BL	T18SHW1 POSTTEST
	RFW#:	011	012	013	014	015	016
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 12.7	< 12.7	< 12.7	< 12.7	< 12.7	< 12.7
RDX		< 9.80	< 9.80	< 9.80	< 9.80	< 9.80	< 9.80
1,3,5-TNB		< 20.9	< 20.9	< 20.9	< 20.9	< 20.9	< 20.9
1,3-DNB		< 5.90	< 5.90	< 5.90	< 5.90	< 5.90	< 5.90
NITROBENZENE		< 13.7G	< 5.30G	< 4.20	< 4.20	< 26.9G	< 69.5G
TETRYL		< 50.0	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0
2,4,6-TNT		< 19.2	< 19.2	< 19.2	< 19.2	< 19.2	< 19.2
2,6-DNT		< 4.00	< 4.00	< 4.00	< 4.00	< 4.00	< 4.00
2,4-DNT		< 4.20	< 4.20	< 4.20	< 4.20	< 4.20	< 4.20

WESTON ANALYTICS
EXPLOSIVES IN WIPE SAMPLES DATA SUMMARY

RFW Batch Number: 8909L804 CLIENT: USATHAMA-HWAAP

Sample Information		Client ID :	T18SH FIELD BL		---	---	---
		RFW#:	017		BLANK	2XSS	10XSS
		D.F.:	1		1	1	1
		Units:	Total ug		Total ug	Total ug	Total ug
HMX	<	12.7		<	1.27	1.91(74.2%)	9.37(73.1%)
RDX	<	9.80		<	9.80	1.62(81.6%)	7.68(77.7%)
1,3,5-TNB		39.6		<	2.09	3.19(75.2%)	16.4(77.4%)
1,3-DNB	<	5.90		<	0.59	0.98(82.2%)	4.84(82.5%)
NITROBENZENE	<	4.20		<	0.42	0.74(87.7%)	3.69(87.7%)
TETRYL	<	50.0		<	5.00	6.82(67.6%)	37.1(73.4%)
2,4,6-TNT	<	19.2		<	1.92	3.25(83.6%)	14.8(76.3%)
2,6-DNT	<	4.00		<	0.40	0.59(72.9%)	2.95(73.1%)
2,4-DNT	<	4.20		<	0.42	0.68(80.7%)	3.42(80.9%)

Sample Information	Client ID :	---
	RFW#:	10XSSD
	D.F.:	1
	Units:	Total ug
HMX		8.14(63.5%)
RDX		6.94(70.2%)
1,3,5-TNB		14.8(70.0%)
1,3-DNB		4.44(74.9%)
NITROBENZENE		3.47(82.2%)
TETRYL		30.9(61.2%)
2,4,6-TNT		13.1(67.6%)
2,6-DNT		2.75(68.4%)
2,4-DNT		3.10(73.2%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP **SAMPLES RECEIVED:** 09-20-89
RFW #: 8909L803 - RINSATES
W.O. #: 2281-08-02

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
BLK =	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS =	Designates sample spiked with target compound.
SSD =	Designates sample spiked with target compound in duplicate.
D =	Indicates duplicate analysis of a sample.
NS =	Not spiked.
DL =	Diluted below calibration range.
G =	Indicates elevated detection limit due to sample interference.
NR =	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than
> = Greater Than

Analysis Summary

Samples Collected: 09-18-89
Samples Prepared: 09-22-89
Samples Analyzed: 09-22-89

[signature] 10-13-89
Carter Nulton, Ph.D. Date
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS
EXPLOSIVES IN RINSATE DATA SUMMARY

RFW Batch Number: 8909L803 CLIENT: USATHAMA HWAAP

Sample Information	Client ID :	T16CP	T18PB1	T18PB1	T18PB1	T18PB1	T18PB
		FIELD BL	R1	R2	R3	R4	FIELD BL
	RFW#:	002	003	004	005	006	007
	D.F.:	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 318	< 318	< 318	< 318	< 318	< 318
RDX		< 245	< 245	< 245	< 245	< 245	< 245
1,3,5-TNB		< 523	< 523	< 523	< 523	< 523	< 523
1,3-DNB		< 148	< 148	< 148	< 148	< 148	< 148
NITROBENZENE		< 105	< 105	< 105	< 105	< 105	< 105
TETRYL		< 1250	< 1250	< 1250	< 1250	< 1250	< 1250
2,4,6-TNT		997	< 480	< 480	< 480	< 480	< 480
2,6-DNT		< 100	< 100	< 100	< 100	< 100	< 100
2,4-DNT		< 105	< 105	< 105	< 105	< 105	< 105

Sample Information	Client ID :	T18SHR1	T18SHR1	T18SHR1	T18SHR1	T18SHR
		R1	R2	R3	R4	FIELD BL
	RFW#:	008	009	010	011	012
	D.F.:	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 318	< 318	< 318	< 318	< 318
RDX		< 245	< 245	< 245	< 245	< 245
1,3,5-TNB		< 523	< 523	< 523	< 523	< 523
1,3-DNB		< 148	< 148	< 148	< 148	< 148
NITROBENZENE		< 105	< 105	< 105	< 105	< 105
TETRYL		< 1250	< 1250	< 1250	< 1250	< 1250
2,4,6-TNT		< 480	< 480	< 480	< 480	< 480
2,6-DNT		< 100	< 100	< 100	< 100	< 100
2,4-DNT		< 105	< 105	< 105	< 105	< 105

WESTON ANALYTICS
EXPLOSIVES IN RINSATE DATA SUMMARY

RFW Batch Number: 8909L803 CLIENT: USATHAMA HWAAP

Sample Information	Client ID :	---	---	---
	RFW#:	BLANK	2XSS	10XSS
	D.F.:	1	1	1
	Units:	Total ug	Total ug	Total ug
HMX		< 1.27	2.31(89.7%)	11.1(86.4%)
RDX		< 0.98	1.89(95.1%)	8.74(88.4%)
1,3,5-TNB		< 2.09	3.63(85.6%)	18.7(88.6%)
1,3-DNB		< 0.59	1.10(92.4%)	5.44(91.7%)
NITROBENZENE		< 0.42	0.83(97.6%)	4.11(97.4%)
TETRYL		< 5.00	8.35(82.7%)	44.8(88.8%)
2,4,6-TNT		< 1.92	3.77(97.1%)	17.6(90.8%)
2,6-DNT		< 0.40	0.68(83.4%)	3.42(84.9%)
2,4-DNT		< 0.42	0.78(91.9%)	3.97(93.8)

Sample Information	Client ID :	---
	RFW#:	10XSSD
	D.F.:	1
	Units:	Total ug
HMX		10.4(81.1%)
RDX		8.19(82.9%)
1,3,5-TNB		17.6(83.1%)
1,3-DNB		5.15(86.8%)
NITROBENZENE		3.97(94.0%)
TETRYL		41.6(82.3%)
2,4,6-TNT		16.4(84.7%)
2,6-DNT		3.29(81.5%)
2,4-DNT		3.77(84.0%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP   SAMPLES RECEIVED: 09-20-89
RFW #: 8909L303 - SOIL
W.O. #: 2231-08-02

EXPLOSIVES NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS	=	Designates sample spiked with target compound.
BSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than
> = Greater Than

Analysis Summary

Samples Collected: 09-18-89
Samples Prepared: 09-22-89
Samples Analyzed: 09-22-89

[signature] 10-13-89
Carter Nulton, Ph.D. Date
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS
EXPLOSIVES IN SOIL DATA SUMMARY

RFW Batch Number: 8909L803   CLIENT: USATHAMA-HWAAP

Sample Information					
	Client ID :	T18CP SOLID	---	---	---
	RFW#:	001	BLANK	2XSS	10XSS
	D.F.:	1	1	1	1
	Units:	ug/g	Total ug	Total ug	Total ug
HMX		< 1.27	< 1.27	2.88(113%)	11.8(92.8%)
RDX		< 0.98	< 0.98	2.18(111%)	8.89(90.7%)
1,3,5-TNB		< 2.09	< 2.09	4.58(110%)	20.4(97.5%)
1,3-DNB		< 0.59	< 0.59	1.36(115%)	5.85(99.3%)
NITROBENZENE		< 0.42	< 0.42	0.92(110%)	4.12(98.4%)
TETRYL		< 5.00	< 5.00	11.3(113%)	48.8(97.5%)
2,4,6-TNT		< 1.92	< 1.92	4.63(120%)	16.6(97.1%)
2,6-DNT		< 0.40	< 0.40	0.90(112%)	3.91(97.7%)
2,4-DNT		< 0.42	< 0.42	0.94(112%)	4.11(97.8%)

Sample Information		
	Client ID :	---
	RFW#:	10XSSD
	D.F.:	1
	Units:	Total ug
HMX		13.4(105%)
RDX		10.0(102%)
1,3,5-TNB		22.5(108%)
1,3-DNB		6.48(110%)
NITROBENZENE		4.56(109%)
TETRYL		55.5(111%)
2,4,6-TNT		20.8(108%)
2,6-DNT		4.31(108%)
2,4-DNT		4.50(107%)

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE   SAMPLES RECEIVED: 09-22-89
RFW #: 8909L351, RINSATES
W.O. #: 2281-03-02

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than   > = Greater Than

Analysis Summary

Samples Collected: 09-20-89
Samples Prepared: 09-26-89
Samples Analyzed: 10-24-89

Leon Perry (for)   11/6/89

Carter Nulton, Ph.D.   Date
Vice President/Laboratory Manager
Lionville Analytical Laboratory

WESTON ANALYTICS
EXPLOSIVES IN RINSATE DATA SUMMARY

RFW Batch Number: 8909L851 CLIENT: USATHAMA-HAWTHORNE

Sample Information	Client ID :	T18 MOTOR SOAK TEST	---	---
	RFW#:	001	2XTS	10XSS
	D.F.:	1400	1	1
	Units:	Total ug	Total ug	Total ug
HMX		< 220	2.43(94.4%)	13.1(102%)
RDX		< 170	1.82(92.0%)	10.1(102%)
1,3,5-TNB		< 370	4.02(94.8%)	21.6(102%)
1,3-DNB		< 100	1.14(95.8%)	6.05(102%)
Nitrobenzene		< 74	0.79(94.5%)	4.35(103%)
Tetryl		< 880	6.47(64.0%)	46.4(91.9%)
2,4,6-TNT		< 340	2.72(69.9%)	17.4(89.9%)
2,6-DNT		< 70	0.86(106%)	4.24(105%)
2,4-DNT		< 70	0.82(96.4%)	4.34(103%)

Sample Information	Client ID :	---	---
	RFW#:	10XSSD	BLANK
	D.F.:	1	1
	Units:	Total ug	Total ug
HMX		12.5(97.2%)	< 1.27
RDX		9.74(98.6%)	< 0.98
1,3,5-TNB		21.1(99.6%)	< 2.09
1,3-DNB		5.90(99.5%)	< 0.59
Nitrobenzene		4.25(101%)	< 0.42
Tetryl		42.8(84.8%)	< 5.00
2,4,6-TNT		15.5(79.9%)	< 1.92
2,6-DNT		4.16(103%)	< 0.40
2,4-DNT		4.23(100%)	< 0.42

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: IAAP
RFW #: 9001L325-Wipes
W.O. #: 2231-03-02

SAMPLES RECEIVED: 01-25-90

EXPLOSIVES NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Modified for the analysis of wipe samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than
> = Greater Than

Analysis Summary

Samples Collected: 01-26-90
Samples Prepared: 01-30-90
Samples Analyzed: 01-30-90

[signature] 2-12-90

Carter Nulton, Ph.D.
Vice President
Lionville Analytical Laboratory

Date

Roy F. Weston, Inc. - Lionville Laboratory
EXP ANALYTICAL DATA PACKAGE FOR
USATHAMA-SWAAP

DATE RECEIVED: 01/26/90 RFW LOT # :9001L326

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
T13 CLAY PIPE POST T	001	WI		01/26/90		

WESTON ANALYTICS
WIPE EXPLOSIVES DATA

RFW Batch Number: 9001L326 CLIENT: RAAAP

Sample Information					
	Client	T 18 CLAYPIPE POST T	---	---	---
	ID:				
	RFW#:	001	BLANK	2XSS	10XSS
	D.F.:	10	1	1	NA
	Units:	Total ug	Total ug	Total ug	Total ug
HMX		< 12.7	< 1.27	2.18(86.8%)	11.6(90.1%)
RDX		< 9.80	< 0.98	1.71(87.1%)	8.86(90.3%)
1,3,5-TNB		< 20.9	< 2.09	3.63(91.2%)	19.8(94.3%)
1,3-DNB		< 5.90	< 0.59	1.07(96.7%)	5.86(99.3%)
NITROBENZENE		< 55.4	< 0.42	1.08(93.7%)	4.83(115%)
TETRYL		< 50.0	< 5.00	8.94(94.6%)	49.5(98.9%)
2,4,6-TNT		< 19.2	< 1.92	3.63(98.3%)	19.7(120%)
2,6-DNT		< 4.00	< 0.40	0.73(89.2%)	3.90(97.5%)
2,4-DNT		< 4.20	< 0.42	0.72(89.9%)	4.00(95.3%)

Sample Information		
	Client	---
	ID:	
	RFW#:	10XSSD
	D.F.:	1
	Units:	Total ug
HMX		11.7(91.2%)
RDX		9.00(91.2%)
1,3,5-TNB		20.1(95.9%)
1,3-DNB		5.86(99.3%)
NITROBENZENE		4.55(108%)
TETRYL		49.0(98.0%)
2,4,6-TNT		19.3(118%)
2,6-DNT		3.77(94.1%)
2,4-DNT		3.93(93.9%)

20
2-13

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: HMAAP
RFW #: 9001L326-Soil
W.O. #: 2231-08-02

SAMPLES RECEIVED: 01-26-90

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in soil.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Soil results are reported in a dry weight basis.

Data Qualifiers

< = Less Than   > = Greater Than

Analysis Summary

Samples Collected: 01-26-90
Samples Prepared: 01-30-90
Samples Analyzed: 01-30-90

[signature] 2-12-90
Carter Nulton, Ph.D. Date
Vice President
Lionville Analytical Laboratory

Roy F. Weston, Inc. - Lionville Laboratory
REP ANALYTICAL DATA PACKAGE FOR
USATHAMA-RVAAP

DATE RECEIVED: 01/26/90 RFW LOT # :9001L325

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
T13 CLAYPIPE GROUND	002	WI		01/26/90		

WESTON ANALYTICS
SOIL EXPLOSIVES DATA

RFW Batch Number: 9001L326 CLIENT: HWAAP

Sample Information					
	Client ID:	T 18 CLAYPIPE GROUND	---	---	---
	RFW#:	002	BLANK	2XSS	10XSS
	D.F.:	1	1	1	NA
	Units:	Total ug	Total ug	Total ug	Total ug
HMX		< 1.27	< 1.27	2.20(86.8%)	10.6(83.5%)
RDX		< 0.98	< 0.98	1.70(87.1%)	7.82(79.8%)
1,3,5-TNB		< 2.09	< 2.09	3.82(91.2%)	18.9(89.9%)
1,3-DNB		< 0.59	< 0.59	1.14(96.7%)	5.56(94.3%)
NITROBENZENE		< 0.42	< 0.42	0.784(93.7%)	3.79(90.3%)
TETRYL		< 5.00	< 5.00	9.46(94.6%)	47.1(94.1%)
2,4,6-TNT		< 1.92	< 1.92	3.77(98.3%)	18.2(111%)
2,6-DNT		< 0.40	< 0.40	0.71(89.2%)	3.55(88.7%)
2,4-DNT		< 0.42	< 0.42	0.75(89.9%)	3.68(87.7%)

Sample Information		
	Client ID:	---
	RFW#:	10XSSD
	D.F.:	1
	Units:	Total ug
HMX		10.6(83.3%)
RDX		7.82(79.7%)
1,3,5-TNB		18.86(89.9%)
1,3-DNB		5.63(95.5%)
NITROBENZENE		3.84(91.5%)
TETRYL		46.6(93.1%)
2,4,6-TNT		18.0(110%)
2,6-DNT		3.56(88.9%)
2,4-DNT		3.71(88.4%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,253,315,393,462,524,534,595
8909L595,679,804
W.O. #: 2231-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

[signature] 2/21/90

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-03-02-0000

WESTON BATCH #: 8909L679

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-028	T18SMW2 PRE TEST	NITRATED ESTERS	27.6		UG	20.(
-029	T18SM FIELD BLANK	NITRATED ESTERS	5.0	u	UG	5.(

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L679

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L67[illegible]

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.
		NITRATED ESTERS	48.8	2.5 u	50.0	97.

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L679

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-M82	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-02-0000

WESTON BATCH #: 8909L304

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	T18 SMW2	NITRATED ESTERS	5.0	u	UG	5.0
-002	T18 SM FIELD BLANK	NITRATED ESTERS	5.0	u	UG	5.0
-003	T18 FLSH CHMB WA W2	NITRATED ESTERS	5.0	u	UG	5.0
-004	T18 FLSH CHMB WA BLN	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L804

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC014-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC014-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-02-0000

WESTON BATCH #: 3909L30

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC014-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC014-MB2	NITRATED ESTERS	49.3	2.5 u	50.0	99
		NITRATED ESTERS	48.9	2.5 u	50.0	97

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L804

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC014-MB2	NITRATED ESTERS	99.5	97.7	1.8

APPENDIX G

ANALYTICAL DATA SUMMARY TABLES FOR STACK TEST PROGRAM

APPENDIX G

Appendix G contains data collected from stack testing that was conducted during T2, T3, and T5. Two types of data are included. The first type consists of raw operational data from the flash chamber inlet, flash chamber outlet, and the afterburner outlet. These data were used to generate Tables 3-6, 3-7, and 3-8 in the main report. The following information is included:

- Flash chamber inlet
  - Test data.
  - Inputs for calculations.
  - CEM report data for total hydrocarbons.
- Flash Chamber Outlet (sheet 1, explosives data)
  - Test data.
  - Inputs for calculations.
  - Laboratory report data for explosives.
- Flash Chamber Outlet (sheet 2, smokeless powder data)
  - Test data.
  - Inputs for calculations.
  - Smokeless powder results from sample train.
  - CEM report data for total hydrocarbons.
- Afterburner Outlet (sheet 1, explosives data)
  - Test data.
  - Inputs for calculations.
  - Laboratory report data for explosives.
- Afterburner Outlet (sheet 2, smokeless powder and particulate data)
  - Test data.
  - Inputs for calculations.
  - Laboratory report data.
    - Particulate catch.
    - Smokeless powder catch.
  - CEM report data for NOx and total hydrocarbons.

The second type of data consists of analytical data summaries generated by the offsite laboratory (WESTON Analytics Division, Lionville, Pennsylvania). The analytical data summaries provide the following information:

- Inorganic narrative (explosives narrative presented, where applicable).

- Glossary of terms.
- Inorganics data summary report.
- Inorganics quality assurance/quality control (QA/QC) report.
- Explosives narrative.
- Explosives data summary.

The inorganic narrative is generally a summary of the quality control results and a description of any problems encountered during the analysis of the samples. The glossary of terms defines the data qualifiers used in the report, abbreviations, and laboratory chronology and holdtime report codes.

The inorganics data summary presents the actual results of the analysis. In addition, the lab sample number, site ID, analyte tested, and the reporting limit are provided.

The inorganics QA/QC report includes the analysis of a method blank, inorganics accuracy report, and an inorganics duplicate spike report.

July 1990
Revision: Final

STACK TEST 2

400°F/24 HOURS

RAW OPERATIONAL DATA

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data			
Run number	T2-1	T2-2	T2-3
Location		FLASH CHAMBER INLET	
Date	07-25-89	07-25-89	07-26-89
Time period	0840-1345	1720-2200	0950-1400
Operator	JDO	JDO	JDO
Inputs For Calcs.			
Sq. rt. delta P	0.430120	0.441590	0.458260
Delta H	0.75000	0.75000	0.75000
Stack temp. (deg.F)	380.75	311.37	743.00
Meter temp. (deg.F)	100.00	97.00	99.00
Sample volume (act.)	164.255	143.865	125.522
Barometric press. (in.Hg)	26.44	26.44	26.40
Volume H20 imp. (ml)	75.00	50.00	25.00
Weight chnge sil. gel (g)	37.00	39.00	34.00
% CO2	1.900	1.900	1.600
% O2	17.000	17.000	17.500
ppm CO	131.300	175.100	200.300
% N	81.100	81.100	80.900
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	305.00	280.00	250.00
Static pressure (in.H20)	0.06	0.06	0.06
Nozzle dia. (in.)	NA	NA	NA
Meter box cal.	0.9991	0.9991	0.9991
Cp of pitot tube	0.84	0.84	0.84

Cem Report Data

Total Hydrocarbon PPM	29.6	39.8	45.6

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	EXPLOSIVES TEST		
Run number	T2-1	T2-2	T2-3
Location	FLASH CHAMBER OUTLET		
Date	7-25-89	7-25-89	7-26-89
Time period	0830-1536	1558-2331	0945-1414
Operator	JDO/SK	SK/WS	SK/WS
Inputs For Calcs.			
Sq. rt. delta P	0.434755	0.510594	0.506651
Delta H	1.10547	1.40764	1.35625
Stack temp. (deg.F)	345.42	405.99	424.35
Meter temp. (deg.F)	105.74	102.26	106.54
Sample volume (act.)	233.731	324.082	171.536
Barometric press. (in.Hg)	26.44	26.31	26.40
Volume H2O imp. (ml)	72.00	116.00	35.00
Weight chnge sil. gel (g)	57.00	64.35	37.00
% CO2	1.200	1.100	1.100
% O2	16.200	18.400	18.300
CO ppm	86.700	92.800	122.700
% N	82.600	80.600	80.600
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	360.00	445.00	240.00
Static pressure (in.H2O)	-0.44	-0.56	-0.54
Nozzle dia. (in.)	0.300	0.300	0.300
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug

	T2-1	T2-2	T2-3
HMX	< 3180.00	< 3180.00	4.18
RDX	< 2450.00	< 2450.00	< 2.45
Trinitrobenzene (1 3 5 TNB)	< 5230.00	< 5230.00	< 5.23
Dinitrobenzene (1 3 DNB)	< 1480.00	< 1480.00	4.46
Nitrobenzene	< 1050.00	< 1050.00	< 1.05
Tetryl	< 12500.00	< 12500.00	< 12.50
2 4 6 Trinitrotoluol (TNT)	70400.00	39600.00	93.50
2 4 Dinitrotoluene (2 4 DNT)	< 1050.00	< 1050.00	< 1.05
2 6 Dinitrotoluene (2 6 DNT)	< 1000.00	< 1000.00	< 1.00

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data		PARTICULATE TEST	
Run number	T2-1	T2-2	T2-3
Location		FLASH CHAMBER OUTLET	
Date	7-25-89	7-25-89	7-25-89
Time period	0930-1526	1629-2331	0945-1444
Operator	JDO/DK	DK/YS	DK/YS
Inputs For Calcs.			
Sq. rt. delta P	0.540399	0.501335	0.499036
Delta H	1.52442	1.30774	1.73563
Stack temp. (deg.F)	345.39	403.76	423.33
Meter temp. (deg.F)	113.38	103.62	114.74
Sample volume (act.)	248.242	315.569	130.476
Barometric press. (in.Hg)	25.44	25.31	26.40
Volume H2O imp. (ml)	32.00	109.00	52.00
Weight chnge sil. gel (g)	45.00	66.00	37.00
% CO2	1.200	1.100	1.100
% O2	16.200	18.400	18.300
CO ppm	26.700	92.300	122.700
% N	32.500	30.500	20.600
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	360.00	420.00	240.00
Static pressure (in.H2O)	-0.50	-0.57	-0.57
Nozzle dia. (in.)	0.310	0.310	0.310
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84
Smokeless powder			
Total Nitrated Esters, ug	30003.5	13601.49	1591.88
Cem Report Data			
Total Hydrocarbon PPM	23.9	28.9	34.3

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data			
	EXPLOSIVES TEST		
Run number	T2-1	T2-2	T2-3
Location	AFTERBURNER OUTLET		
Date	7-25-89	7-25-89	7-26-89
Time period	0820-1537	1640-2340	0945-1444
Operator	GM/SK	GM/NS	GM/SK
Inputs For Calcs.			
Sq. rt. delta P	0.089896	0.103104	0.099647
Delta H	0.53191	1.01125	0.955208
Stack temp. (deg.F)	1725.68	1790.24	1721.35
Meter temp. (deg.F)	112.41	108.92	114.64
Sample volume (act.)	167.991	224.444	144.556
Barometric press. (in.Hg)	25.44	26.31	25.40
Volume H2O imp. (ml)	280.00	320.00	175.00
Weight chnge sil. gel (g)	43.00	55.00	31.00
% CO2	7.100	6.500	5.000
% O2	9.300	10.700	11.500
PPM CO	7.500	6.000	7.000
% N	83.000	82.800	82.500
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	340.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.760	0.800	0.800
Meter box cal.	0.9953	0.9953	0.9953
Cp of pitot tube	0.84	0.84	0.84
Laboratory Report Data, Total ug			
HMX	12.52	2.16	< 1.27
RDX	< 0.98	< 0.98	2.92
Trinitrobenzene (1 3 5 TNB)	5.90	< 2.09	< 2.09
Dinitrobenzene (1 3 DNB)	0.50	0.24	0.87
Nitrobenzene	< 0.42	< 0.42	< 0.42
Tetryl	< 5.00	< 5.00	< 5.00
2 4 6 Trinitrotoluol (TNT)	< 1.92	< 1.92	< 1.92
2 4 Dinitrotoluene (2 4 DNT)	< 0.42	< 0.42	< 0.42
2 6 Dinitrotoluene (2 6 DNT)	< 0.40	< 0.40	< 0.40

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	SMOKELESS POWDER AND PARTICULATE TEST		
Run number	T2-1	T2-2	T2-3
Location	AFTERBURNER OUTLET		
Date	7-25-89	7-25-89	7-26-89
Time period	0830-1537	1640-2340	0945-1414
Operator	JM/SK	JM/WS/SK	JM/WS
Inputs For Calcs.			
Sq. rt. delta P	0.099753	0.101708	0.104104
Delta H	1.45147	1.52653	1.19458
Stack temp. (deg.F)	1663.93	1703.97	1689.71
Meter temp. (deg.F)	109.30	105.31	110.35
Sample volume (act.)	235.949	256.203	151.315
Barometric press. (in.Hg)	26.44	26.31	26.40
Volume H2O imp. (ml)	339.00	340.00	198.00
Weight chnge sil. gel (g)	50.00	56.00	35.00
% CO2	7.10	6.50	6.00
% O2	9.70	10.70	11.50
PPM CO	7.50	6.00	7.00
% N	83.00	82.80	82.50
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	340.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.360	0.360	0.310
Meter box cal.	1.0030	1.0030	1.0030
Cp of pitot tube	0.84	0.84	0.84
Laboratory Report Data			
Front half acetone, g.	0.0049	0.0018	0.0024
Filter catch, g.	0.0025	0.0018	0.0020
Total particulate catch,g.	0.0074	0.0036	0.0044
Smokeless powder			
Nitrated Esters	< 1805	< 1660	< 1447
Cem Report Data			
NOx PPM	58.9	54.6	54.8
Total Hydrocarbon PPM	0.2	0.0	0.3

STACK TEST 3

500°F/36 HOURS

RAW OPERATIONAL DATA

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data			
Run number	T3-1	T3-2	T3-3
Location		FLASH CHAMBER INLET	
Date	07-17-89	07-17-89	07-18-89
Time period	0450-1206	1449-1900	1440-2100
Operator	JDO	JDO	JDO
Inputs For Calcs.			
Sq. rt. delta P	0.489900	0.529150	0.524400
Delta H	1.00000	0.75000	0.70000
Stack temp. (deg.F)	1123.00	1030.30	933.20
Meter temp. (deg.F)	110.00	100.00	103.00
Sample volume (act.)	238.741	127.621	190.899
Barometric press. (in.Hg)	26.48	25.94	25.97
Volume H2O imp. (ml)	115.00	50.00	50.00
Weight chnge sil. gel (g)	20.00	23.00	47.00
% CO2	2.400	2.200	1.800
% O2	15.800	16.500	16.700
ppm CO	9.200	55.500	113.600
% N	81.600	81.300	81.500
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	436.00	251.00	380.00
Static pressure (in.H2O)	0.06	0.06	0.06
Nozzle dia. (in.)	NA	NA	NA
Meter box cal.	0.9991	0.9991	0.9991
Cp of pitot tube	0.84	0.84	0.84

Cem Report Data

Total Hydrocarbon PPM	49.0	33.1	38.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

EXPLOSIVES TEST

Test Data			
Run number	T3-1	T3-2	T3-3
Location	FLASH CHAMBER OUTLET		
Date	7-17-89	7-17-89	7-18-89
Time period	0445-1226	1439-2221	1433-2134
Operator	JDO/WS	JDO/SK	JDO/WS

Inputs For Calcs.			
Sq. rt. delta P	0.461140	0.442933	0.502224
Delta H	1.03389	0.92759	1.20219
Stack temp. (deg.F)	440.22	510.21	512.69
Meter temp. (deg.F)	96.24	113.48	111.92
Sample volume (act.)	229.737	146.367	243.272
Barometric press. (in.Hg)	25.48	25.94	25.97
Volume H2O imp. (ml)	100.00	74.00	124.00
Weight chnge sil. gel (g)	56.00	31.00	49.00
% CO2	1.400	1.300	1.100
% O2	17.200	17.500	17.500
PPM CO	19.000	100.400	169.000
% N	81.400	81.200	81.300
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	360.00	240.00	360.00
Static pressure (in.H2O)	-0.48	-0.48	-0.56
Nozzle dia. (in.)	0.300	0.300	0.300
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug			
HMX	< 3180.00	< 31.80	< 12.70
RDX	< 2450.00	< 24.50	< 9.80
Trinitrobenzene (1 3 5 TNB)	< 5230.00	< 52.30	21.70
Dinitrobenzene (1 3 DNB)	< 1480.00	< 14.80	< 5.90
Nitrobenzene	< 1050.00	< 10.50	22.00
Tetryl	< 12500.00	< 125.00	< 50.00
2 4 6 Trinitrotoluol (TNT)	89200.00	64.20	171.00
2 4 Dinitrotoluene (2 4 DNT)	< 1050.00	< 10.50	< 4.20
2 6 Dinitrotoluene (2 6 DNT)	< 1000.00	< 10.00	< 4.00

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	PARTICULATE TEST		
Run Number	T3-1	T3-2	T3-3
Location	FLASH CHAMBER OUTLET		
Date	7-17-89	7-17-89	7-18-89
Time period	0445-1223	1441-2221	1434-2134
Operator	JOC/WS	JM/SK	JM/WS
Inputs For Calcs.			
Sq. rt. delta P	0.456053	0.443826	0.460654
Delta H	1.45326	1.23292	1.22875
Stack temp. (deg.F)	440.39	509.35	498.24
Meter temp. (deg.F)	103.47	119.31	113.28
Sample volume (act.)	240.263	156.530	240.406
Barometric press. (in.Hg)	26.48	25.74	25.77
Volume H2O imp. (ml)	107.00	75.00	128.00
Weight chnge sil. gel (g)	40.00	33.00	46.00
% CO2	1.400	1.300	1.100
% O2	17.200	17.500	17.600
PPM CO	19.000	100.400	169.000
% N	81.400	81.200	81.300
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	370.00	240.00	360.00
Static pressure (in.H2O)	-0.48	-0.50	-0.52
Nozzle dia. (in.)	0.310	0.310	0.310
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84
Smokeless powder			
Nitrated Esters	35692.58	3099.38	7703.13
Cem Report Data			
Total Hydrocarbon PPM	33.9	27.8	27.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

EXPLOSIVES TEST

Test Data			
Run number	T3-1	T3-2	T3-3
Location	AFTERBURNER OUTLET		
Date	7-17-89	7-17-89	7-18-89
Time period	0445-1226	1440-2221	1433-2134
Operator	GM/WS	GM/SK	GM/WS
Inputs For Calcs.			
Sq. rt. delta P	0.090423	0.084823	0.096900
Delta H	0.80397	0.54542	0.72431
Stack temp. (deg.F)	1818.47	1802.19	1806.30
Meter temp. (deg.F)	98.33	116.21	118.50
Sample volume (act.)	174.486	112.964	191.591
Barometric press. (in.Hg)	25.48	25.94	25.97
Volume H2O imp. (ml)	275.00	185.00	310.00
Weight chnge sil. gel (g)	42.00	25.00	43.00
% CO2	6.500	6.700	6.200
% O2	10.300	11.000	11.200
PPM CO	4.900	1.300	6.600
% N	83.200	82.300	82.600
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	360.00	240.00	360.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.760	0.760	0.760
Meter box cal.	0.9953	0.9953	0.9953
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug

	T3-1	T3-2	T3-3
HMX	< 1.27	< 1.27	< 1.27
RDX	3.81	3.82	2.80
Trinitrobenzene (1 3 5 TNB)	< 2.09	3.46	2.78
Dinitrobenzene (1 3 DNB)	5.60	8.40	5.17
Nitrobenzene	< 0.42	20.20	< 0.42
Tetryl	< 5.00	< 5.00	< 5.00
2 4 6 Trinitrotoluol (TNT)	< 1.92	< 1.92	< 1.92
2 4 Dinitrotoluene (2 4 DNT)	< 0.42	< 0.42	< 0.42
2 6 Dinitrotoluene (2 6 DNT)	< 0.40	< 0.40	< 0.40

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data		PARTICULATE TEST	
Run number	T3-1	T3-2	T3-3
Location		AFTERBURNER OUTLET	
Date	7-17-89	7-17-89	7-18-89
Time period	0645-1226	1440-2221	1434-2134
Operator	JM/WS	JM/GK	JM/WS
Inputs For Calcs.			
Sq. rt. delta P	0.073102	0.084311	0.087440
Delta H	0.83597	1.07917	1.12131
Stack temp. (deg.F)	1747.29	1800.35	1739.20
Meter temp. (deg.F)	98.10	113.51	114.38
Sample volume (act.)	191.534	142.223	221.776
Barometric press. (in.Hg)	26.48	25.74	25.97
Volume H2O imp. (ml)	328.00	252.00	376.00
Weight chnge sil. gel (g)	40.00	31.00	46.00
% CO2	6.500	5.700	6.200
% O2	10.300	11.000	11.200
PPM CO	4.700	1.300	6.500
% N	83.200	82.300	82.600
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	360.00	240.00	360.00
Static pressure (in.H2O)	-0.09	-0.10	-0.10
Nozzle dia. (in.)	0.360	0.360	0.360
Meter box cal.	1.0030	1.0030	1.0030
Cp of pitot tube	0.84	0.84	0.84
Laboratory Report Data			
Front half acetone, g.	0.0009	0.0030	0.0033
Filter catch, g.	0.0016	0.0019	0.0024
Total particulate catch,g.	0.0025	0.0049	0.0057
Smokeless powder			
Nitrated Esters	3184.97	2237.525	5774.47
Cem Report Data			
NOx PPM	55.4	48.8	47.4
Total Hydrocarbon PPM	0.1	0.3	0.1

STACK TEST 5

500°F/24 HOURS

RAW OPERATIONAL DATA

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data

Run number	TS-1	TS-2	TS-3
Location		FLASHCHAMBER INLET	
Date	07-29-89	07-29-89	07-30-89
Time period	1017-1630	1900-2400	1200-1630
Operator	JDO	JDO	JDO

Inputs For Calcs.

Sq. rt. delta P	0.424260	0.489900	0.435390
Delta H	0.75000	0.75000	0.75000
Stack temp. (deg.F)	373.30	1036.00	397.50
Meter temp. (deg.F)	98.00	92.00	101.50
Sample volume (act.)	183.074	143.763	130.243
Barometric press. (in.Hg)	26.41	26.41	26.38
Volume H2O imp. (ml)	58.00	55.00	44.00
Weight chnge sil. gel (g)	34.00	33.00	23.00
% CO2	1.60	2.20	2.00
% O2	17.40	16.50	16.70
ppm CO	136.00	261.30	206.10
% N	81.00	81.30	81.30
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	373.00	300.00	240.00
Static pressure (in.H2O)	0.05	0.05	0.05
Nozzle dia. (in.)	NA	NA	NA
Meter box cal.	0.9991	0.9991	0.9991
Cp of pitot tube	0.34	0.34	0.34

Cem Report Data

Total Hydrocarbon PPM	32.2	50.8	45.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

EXPLOSIVES TEST

Test Data			
Run number	T5-1	T5-2	T5-3
Location	FLASH CHAMBER OUTLET		
Date	7-[illegible]-89	7-[illegible]-89	7-30-89
Time period	[illegible]-1720	1822-0129	1221-1719
Operator	SK/MS	MS/SK	SK/MS

Inputs For Calcs.			
Sq. rt. delta P	0.[illegible]	0.528697	0.502866
Delta H	1.[illegible]	1.37347	1.20000
Stack temp. (deg.F)	[illegible]	479.64	521.23
Meter temp. (deg.F)	106.33	99.28	103.00
Sample volume (act.)	254.[illegible]	256.323	161.635
Barometric press. (in.Hg)	[illegible]	26.41	26.37
Volume H2O imp. (ml)	[illegible]	73.00	50.00
Weight chnge sil. gel (g)	49.00	66.00	34.00
% CO2	1.200	1.600	1.600
% O2	18.100	17.400	17.500
PPM CO	106.000	171.200	188.500
% N	80.700	81.000	80.900
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.49	-0.58	-0.57
Nozzle dia. (in.)	0.300	0.300	0.300
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug			
HMX	< 2380.00	< 127.00	< 12.70
RDX	< 1840.00	< 98.00	< 9.80
Trinitrobenzene (1 3 5 TNB)	< 3920.00	< 209.00	< 20.90
Dinitrobenzene (1 3 DNB)	< 1110.00	< 59.00	< 5.90
Nitrobenzene	< 788.00	< 42.00	< 4.20
Tetryl	< 9380.00	< 500.00	< 50.00
2 4 6 Trinitrotoluol (TNT)	76800.00	677.00	184.00
2 4 Dinitrotoluene (2 4 DNT)	< 780.00	< 42.00	< 4.20
2 6 Dinitrotoluene (2 6 DNT)	< 750.00	< 40.00	< 4.00

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	PARTICULATE TEST		
Run number	TS-1	TS-2	TS-3
Location	FLASH CHAMBER OUTLET		
Date	7-29-89	7-29-89	7-30-89
Time period	0955-1720	1324-0129	1221-1719
Operator	DK/TS	WS/SK	DK/TS
Inputs For Calcs.			
Sq. rt. delta P	0.455045	0.535253	0.504881
Delta H	1.51256	1.50542	1.54229
Stack temp. (deg.F)	379.36	477.57	519.33
Meter temp. (deg.F)	114.70	107.35	116.51
Sample volume (act.)	278.342	247.516	172.369
Barometric press. (in.Hg)	26.41	26.41	26.37
Volume H2O imp. (ml)	77.00	97.00	62.00
Weight chnge sil. gel (g)	48.00	52.00	34.00
% CO2	1.200	1.600	1.600
% O2	18.100	17.400	17.300
PPM CO	106.000	171.200	158.500
% N	80.700	81.000	80.900
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.50	-0.57	-0.58
Nozzle dia. (in.)	0.310	0.310	0.310
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84
Nitrated Esters	23326.00	1041.31	4389.53
Cem Report Data			
Total Hydrocarbon PPM	25.0	34.7	30.5

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	EXPLOSIVES TEST		
Run number	T5-1	T5-2	T5-3
Location	AFTERBURNER OUTLET		
Date	7-29-89	7-29-89	7-30-89
Time period	0955-1720	1824-0129	1221-1718
Operator	JM/WS	JM/SK	JM/SK
Inputs For Calcs.			
Sq. rt. delta P	0.099307	0.100790	0.096153
Delta H	0.96603	1.00944	0.927500
Stack temp. (deg.F)	1692.26	1703.71	1713.06
Meter temp. (deg.F)	117.94	105.44	119.65
Sample volume (act.)	239.435	219.621	142.086
Barometric press. (in.Hg)	26.41	26.41	26.37
Volume H2O imp. (ml)	358.00	301.00	180.00
Weight chnge sil. gel (g)	46.50	63.00	36.00
% CO2	6.600	6.200	6.100
% O2	10.300	11.000	11.200
PPM CO	6.900	5.600	6.900
% N	83.100	82.300	82.700
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.300	0.800	0.800
Meter box cal.	0.9953	0.9953	0.9953
Cp of pitot tube	0.34	0.34	0.84

Laboratory Report Data, Total ug

	T5-1	T5-2	T5-3
HMX	12.70	1.47	< 1.27
RDX	2.76	2.57	2.84
Trinitrobenzene (1 3 5 TNB)	< 2.09	2.19	7.62
Dinitrobenzene (1 3 DNB)	2.63	7.60	1.90
Nitrobenzene	< 0.42	1.56	1.91
Tetryl	< 5.00	< 5.00	< 5.00
2 4 6 Trinitrotoluol (TNT)	< 1.92	< 1.92	< 1.92
2 4 Dinitrotoluene (2 4 DNT)	< 0.42	< 0.42	< 0.42
2 6 Dinitrotoluene (2 6 DNT)	< 0.40	< 0.40	< 0.40

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	NITRATED ESTERS AND PARTICULATE TEST		
Run number	TS-1	TS-2	TS-3
Location	AFTERBURNER OUTLET		
Date	7-29-89	7-29-89	7-30-89
Time period	0955-1720	1824-0129	1221-1718
Operator	JM/WS	JM/SK	JM/WS
Inputs for Calcs.			
Sq. rt. delta P	0.098273	0.107720	0.101726
Delta H	1.12949	1.35056	1.25958
Stack temp. (deg.F)	1697.56	1712.46	1719.06
Meter temp. (deg.F)	111.77	102.35	111.79
Sample volume (act.)	243.418	242.749	156.510
Barometric press. (in.Hg)	26.41	26.41	26.37
Volume H2O imp. (ml)	316.00	339.00	204.00
Weight chnge sil. gel (g)	53.00	59.00	32.00
% CO2	6.60	6.20	6.10
% O2	10.30	11.20	11.20
PPM CO	6.90	5.50	6.70
% N	83.10	82.30	82.70
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.310	0.310	0.310
Meter box cal.	1.0030	1.0030	1.0030
Cp of pitot tube	0.34	0.34	0.34

Laboratory Report Data			
Front half acetone, g.	0.0029	0.0012	0.0000
Filter catch, g.	0.0015	0.0005	0.0000
Total particulate catch,g.	0.0044	0.0017	0.0000
Nitrated Esters	1847.5 <	2575 <	1413
Cem Report Data			
NOx PPM	57.3	48.7	51.7
Total Hydrocarbon PPM	0.6	0.3	0.4

STACK TEST 2

400°F/24 HOURS

ANALYTICAL DATA SUMMARY

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-19, 20, 8-1
RFW#: 8907L060,073,158, 187
8908L202
W.O.#: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged togethe. and reported as nitrated esters.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/21/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 3907L158

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-015	UH-FCO-PART-BHW T2-1	NITRATED ESTERS	29700		UG	1400
-016	UH-FCO-PART-BHA T2-1	NITRATED ESTERS	743		UG	338
-017	UH-AO-PART-FHA T2-1	PARTICULATE	0.0061		grams	0.0000
-018	UH-AO-PART-FILT-T2-1	PARTICULATE	0.0026		grams	0.0000
-019	UH-AO-PART-BHW-T2-1	NITRATED ESTERS	1550	u	UG	1550
-020	UH-AO-PART-BHA-T2-1	NITRATED ESTERS	250	u	UG	250
-035	UH-FCO-PART-BHW T2-2	NITRATED ESTERS	12600		UG	1250
-036	UH-FCO-PART-BHA T2-2	NITRATED ESTERS	1420		UG	425
-037	UH-AO-PART-FHA T2-2	PARTICULATE	0.0031		grams	0.0000
-038	UH-AO-PART-FILT T2-2	PARTICULATE	0.0018		grams	0.0000
-039	UH-AO-PART-BHW T2-2	NITRATED ESTERS	1480	u	UG	1480
-040	UH-AO-PART-BHA T2-2	NITRATED ESTERS	175	u	UG	175
-051	COMP FLO PT T2-1	NITRATED ESTERS	5.0	u	UG	5.0
-052	COMP AO PT T2-1	NITRATED ESTERS	5.0	u	UG	5.0
-053	COMP FLO PT T2-2	NITRATED ESTERS	11.1		UG	5.0
-054	COMP AO PT T2-2	NITRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-03-04-0000

WESTON BATCH #: 8907L158

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u	MG/L	2.
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u	MG/L	2.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 3907L158

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99.3
		NITRATED ESTERS	49.5	2.5 u	50.0	99.0

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8907L1!

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LMC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/15/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8907L187

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-016	UH-FCO-PART-BHW T2-3	NTRATED ESTERS	1330		UG	1150
-017	UH-FCO-PART-BHA T2-3	NTRATED ESTERS	650	u	UG	650
-018	UH-AO-PART-FHA T2-3	PARTICULATE	0.0037		grams	0.0000
-019	UH-AO-PART FLT-T2-3	PARTICULATE	0.0020		grams	0.0000
-020	UH-AO-PART-BHW T2-3	NTRATED ESTERS	1180	u	UG	1180
-021	UH-AO-PART-BHA T2-3	NTRATED ESTERS	262	u	UG	262
-024	COMP FCO PART T2-3	NTRATED ESTERS	6.4		UG	5.0
-025	COMP AO PART T2-3	NTRATED ESTERS	5.0	u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 8907L137

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTIN LIMIT
BLANK10	89LNC008-MB1	NTRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC008-MB2	NTRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP WESTON BATCH #: 8907L187
WORK ORDER: 2281-03-04-0000

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	39LNC008-MB1	NTRATED ESTERS	10.3	2.5 u	10.0	103
BLANK20	39LNC008-MB2	NTRATED ESTERS	49.6	2.5 u	50.0	99.3
		NTRATED ESTERS	49.5	2.5 u	50.0	99.0

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8907L18

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NTRATED ESTERS	99.3	99.0	0.20

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 07-27-89
RFW #: 8907L158, Air
W.O.#: 2231-08-04

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

<	=	Less than
>	=	Greater than

Analysis Summary:

Samples Collected: 07-25-89
Samples Prepared: 07-28,31-89
Samples Analyzed: 08-07-89

George Perry 8/21/89

Carter Nulton, Ph.D. DATE
Vice President/Laboratory Manager
Lionville Analytical Laboratory

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L158 CLIENT: USATHAMA-HAWTHORNE

Sample Information	Client ID :	T2-1 FCO	T2-1 AO	T2-2 FCO	T2-2 AO	BLANK	---
	RFW#:	047	048	049	050	055	BLANK
	D.F.:	2500	1.0	2500	1.0	1.0	1.0
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 3180	16.6G	< 3180	6.24G	4.08G	< 1.27
RDX		< 2450	< 0.98	< 2450	< 0.98	< 0.98	< 0.98
1,3,5-TNB		< 5230	5.90G	< 5230	< 2.09	< 2.09	< 2.09
1,3-DNB		< 1480	2.78G	< 1480	2.42G	2.18G	< 0.59
NITROBENZENE		< 1050	< 0.42	< 1050	< 0.42	< 0.42	< 0.42
TETRYL		< 12,500	< 5.00	< 12,500	< 5.00	< 5.00	< 5.00
2,4,6-TNT		70,400	< 1.92	39,500	< 1.92	< 1.92	< 1.92
2,6-DNT		< 1000	< 0.40	< 1000	< 0.40	0.42G	< 0.40
2,4-DNT		< 1050	< 0.42	< 1050	< 0.42	< 0.42	< 0.42

Sample Information	Client ID :	---	---	---
	RFW#:	20XSS	100XSS	100XSSD
	D.F.:	1.0	1.0	1
	Units:	Total ug	Total ug	Total ug
HMX		21.9(86.2%)	106(83.4%)	111(87.4%)
RDX		17.3(88.3%)	81.6(83.3%)	85.6(87.3%)
1,3,5-TNB		31.0(74.2%)	158(75.6%)	162(77.5%)
1,3-DNB		7.68(65.1%)	42.3(71.5%)	42.6(72.2%)
NITROBENZENE		< 0.42(0.0%)	3.24(7.71%)	3.19(7.57%)
TETRYL		55.0(55.0%)	330(66.0%)	349(69.8%)
2,4,6-TNT		26(67.7%)	130(67.7%)	129(67.1%)
2,6-DNT		3.09(38.6%)	19.6(49.0%)	18.5(46.3%)
2,4-DNT		5.36(63.8%)	28.2(67.1%)	26.9(64.0%)

G=Elevated

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 07-29-89
RFW #: 8907L137, Air
W.O.#: 2281-08-04

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

<	=	Less than
>	=	Greater than

Analysis Summary:

Samples Collected: 07-26-89
Samples Prepared: 07-29,31-89
Samples Analyzed: 08-07-89

x George Perry 8/21/89

Carter Nulton, Ph.D. DATE
Vice President/Laboratory Manager
Lionville Analytical Laboratory

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L187 CLIENT: USATHAMA-HAWTHORNE

Sample Information				
Client ID :	T2-3 FCO	T2-3 AO	---	---
RFW#:	022	023	BLANK	20XSS
D.F.:	2.5	1.0	1	1
Units:	Total ug	Total ug	Total ug	Total ug
HMX	8.26G	< 1.27	< 1.27	20.8(81.9%)
RDX	< 2.45	2.92G	< 0.98	15.8(80.6%)
1,3,5-TNB	< 5.23	< 2.09	< 2.09	29.1(69.6%)
1,3-DNB	6.64G	3.05G	< 0.59	6.24(52.9%)
NITROBENZENE	< 1.05	< 0.42	< 0.42	< 0.42(0.0%)
TETRYL	< 12.5	< 5.00	< 5.00	53.4(53.4%)
2,4,6-TNT	93.6	< 1.92	< 1.92	21.0(54.7%)
2,6-DNT	< 1.00	< 0.40	< 0.40	2.56(32.0%)
2,4-DNT	< 1.05	< 0.42	< 0.42	4.41(52.5%)

Sample Information		
Client ID :	---	---
RFW#:	100XSS	100XSSD
D.F.:	1	1
Units:	Total ug	Total ug
HMX	99.2(78.1%)	109(85.8%)
RDX	80.8(82.4%)	84.0(85.7%)
1,3,5-TNB	158(75.6%)	157(75.1%)
1,3-DNB	41.7(70.6%)	39.4(66.8%)
NITROBENZENE	1.26(3.00%)	4.27(10.2%)
TETRYL	322(64.4%)	330(66.0%)
2,4,6-TNT	126(65.6%)	124(64.5%)
2,6-DNT	17.7(44.2%)	16.3(40.8%)
2,4-DNT	26.6(63.3%)	24.6(58.6%)

G=Elevated

STACK TEST 3

500°F/36 HOURS

ANALYTICAL DATA SUMMARY

1311R2

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-19, 20, 8-1
RFW#: 8907L060,078,153, 187
8908L202
W.O.#: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

2/21/90

Jack R. Tuschall, Ph.D. Date
Laboratory Manager
Lionville Analytical Laboratory

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 390/L060

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-027	UH-PART-FCO-BHW-T3-1	NITRATED ESTERS	26200		UG	5250
-028	UH-PART-FCO-BHA-T3-1	NITRATED ESTERS	9980		UG	1720
-029	UH-PART-AO-FHA-T3-L1	PARTICULATE	0.0009		grams	0.0000
-030	UH-PART-AO-FILT-T3-1	PARTICULATE	0.0016		grams	0.0000
-031	UH-PART-AO-BHW-T3-1	NITRATED ESTERS	3650		UG	3500
-032	UH-PART-AO-BHA-T3-1	NITRATED ESTERS	800	u	UG	800
-035	UH-PART-FCO-BHW-T3-2	NITRATED ESTERS	8330		UG	1900
-036	UH-PART-FCO-BHA-T3-2	NITRATED ESTERS	1880	u	UG	1880
-037	UH-PART-AO-FHA-T3-2	PARTICULATE	0.0030		grams	0.0000
-038	UH-PART-AO-FLT-T3-2	PARTICULATE	0.0019		grams	0.0000
-039	UH-PART-AO-BHW-T3-2	NITRATED ESTERS	2670		UG	2620
-040	UH-PART-AO-BHA-T3-2	NITRATED ESTERS	500	u	UG	500
-045	UH-BLK-FILT-PART	PARTICULATE	0.0001		grams	0.0000
-046	UH-BLK-ACETONE-PART	PARTICULATE	0.0000		grams	0.0000
-047	UH-BLK-PART-WATER	NITRATED ESTERS	975	u	UG	975
-053	COMP FCO PART T3-1	NITRATED ESTERS	12.7		UG	10.0
-054	COMP AO PART T3-1	NITRATED ESTERS	12.9		UG	10.0
-055	COMP FCO PART T3-2	NITRATED ESTERS	10.0	u	UG	10.0
-056	COMP AO PART T3-2	NITRATED ESTERS	11.4		UG	10.0
-057	COMP OF PART BLANK	NITRATED ESTERS	10.0	u	UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 8907L06(

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTIN LIMIT
BLANK10	89LNC004-MB1	NITRATED ESTERS	5.0	u	MG/L	5.
BLANK20	89LNC004-MB2	NITRATED ESTERS	5.0	u	MG/L	5.
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u	MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u	MG/L	5.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-RVAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8907L060

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC004-MB1	NITRATED ESTERS	10.9	5.0 u	10.0	109
BLANK20	89LNC004-MB2	NITRATED ESTERS	47.8	5.0 u	50.0	95.5
		NITRATED ESTERS	47.9	5.0 u	50.0	95.9
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-03-04-0000

WESTON BATCH #: 8907L06

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC004-MB2	NITRATED ESTERS	95.5	95.9	0.30
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 8907L078

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-015	UH-FCO-PART-BHW-T3-3	NITRATED ESTERS	3080		UG	3120
-016	UH-FCO-PART-BHA-T3-3	NITRATED ESTERS	1120	u	UG	1120
-017	UH-AO-PART-FHA-T3-3	PARTICULATE	0.0033		grams	0.0000
-018	UH-AO-PART-FILT-T3-3	PARTICULATE	0.0024		grams	0.0000
-019	UH-AO-PART-BHW-T3-3	NITRATED ESTERS	6200		UG	3450
-020	UH-AO-PART-BHA-T3-3	NITRATED ESTERS	1200	u	UG	1200
-021	UH-PT-FCO-PRE-H2O	NITRATED ESTERS	725	u	UG	725
-022	UH-PT-FCO-PRE-ACE	NITRATED ESTERS	1250	u	UG	1250
-023	UH-PT-AO-PRE-H2O	NITRATED ESTERS	600	u	UG	600
-024	UH-PT-AO-PRE-ACE	NITRATED ESTERS	975	u	UG	975
-031	COMP FLO PT T3-3	NITRATED ESTERS	11.5		UG	10.0
-032	COMP AO PT T3-3	NITRATED ESTERS	10.0	u	UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/15/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 3307L078

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC004-MB1	NITRATED ESTERS	5.0	u	MG/L	5.
BLANK20	89LNC004-MB2	NITRATED ESTERS	5.0	u	MG/L	5.
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u	MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u	MG/L	5.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 8907L078

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC004-MB1	NITRATED ESTERS	10.9	5.0 u	10.0	109
BLANK20	89LNC004-MB2	NITRATED ESTERS	47.3	5.0 u	50.0	95.5
		NITRATED ESTERS	47.9	5.0 u	50.0	95.9
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 3907L01

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC004-MB2	NITRATED ESTERS	95.5	95.9	0.30
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 07-19-89
RFW #: 8907L060, Air
W.O.#: 2281-08-04

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

<	=	Less than
>	=	Greater than

Analysis Summary:

Samples Collected: 07-17-89
Samples Prepared: 07-20-89
Samples Analyzed: 08-07-89

George Perry for 8/21/89

Carter Nulton, Ph.D. DATE
Vice President/Laboratory Manager
Lionville Analytical Laboratory

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulced in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L060 CLIENT: USATHAMA-HAWTHORNE

Sample Information						
Client ID :	T3-1 FCO	T3-1 AO	T3-2 FCO	T3-2 AO	BLANK	---
RFW#:	048	049	C50	051	052	BLANK
D.F.:	2500	1.0	25	1.0	1.0	1.0
Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX	< 3180	< 1.27	< 31.8	< 1.27	< 1.27	< 1.27
RDX	< 2450	3.81G	< 24.5	3.82G	< 0.98	< 0.98
1,3,5-TNB	< 5230	< 2.09	< 52.3	3.46G	< 2.09	< 2.09
1,3-DNB	< 1480	5.60G	< 14.8	8.40G	< 0.59	< 0.59
NITROBENZENE	< 1050	< 0.42	< 10.5	20.2G	< 0.42	< 0.42
TETRYL	< 12,500	< 5.00	< 125	< 5.00	< 5.00	< 5.00
2,4,6-TNT	89,200	< 1.92	64.2	< 1.92	< 1.92	< 1.92
2,6-DNT	< 1000	< 0.40	< 10.0	< 0.40	< 0.40	< 0.40
2,4-DNT	< 1050	< 0.42	< 10.5	< 0.42	< 0.42	< 0.42

Sample Information			
Client ID :	---	---	---
RFW#:	20XSS	100XSS	100XSSD
D.F.:	1	1	1
Units:	Total ug	Total ug	Total ug
HMX	26.7(105%)	124(97.6%)	130(102%)
RDX	20.2(103%)	99.2(101%)	100(102%)
1,3,5-TNB	44.9(107%)	213(102%)	210(100%)
1,3-DNB	11.4(96.6%)	58.3(98.8%)	53.4(90.5%)
NITROBENZENE	< 0.42(0.0%)	16.2(38.6%)	< 0.42(0.0%)
TETRYL	94.4(94.4%)	475(95.0%)	472(94.4%)
2,4,6-TNT	35.7(92.9%)	185(96.3%)	187(97.4%)
2,6-DNT	7.46(93.2%)	40(100%)	35.7(89.3%)
2,4-DNT	7.96(94.8%)	40.3(96.0%)	38.3(91.1%)

G=Elevated

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE   SAMPLES RECEIVED: 07-19-89
RFW #: 8907L073, Air
W.O.#: 2281-08-04

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

<	=	Less than
>	=	Greater than

Analysis Summary:

Samples Collected: 07-18-89
Samples Prepared: 07-21-89
Samples Analyzed: 08-07-89

George Perry for   8/31/89

Carter Nulton, Ph.D.   DATE
Vice President/Laboratory Manager
Lionville Analytical Laboratory

NOTE: Non-quantitative recoveri · were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysi... Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L078 CLIENT: USATHAMA-HAWTHORNE

Sample Information	Client ID :	T3-3 FCO	T3-3 AO	---	---
	RFW#:	1-6 COM.	7-12 COM.	BLANK	20XSS
	D.F.:	10	1.0	1.0	1.0
	Units:	Total ug	Total ug	Total ug	Total ug
HMX		< 12.7	< 1.27	< 1.27	28.4(111%)
RDX		< 9.80	2.80G	< 0.98	23.5(120%)
1,3,5-TNB		21.7G	2.78G	< 2.09	47.9(115%)
1,3-DNB		< 5.90	5.37G	< 0.59	10.4(88.1%)
NITROBENZENE		22.0G	< 0.42	< 0.42	0.42(0.0%)
TETRYL		< 50.0	< 5.00	< 5.00	111(111%)
2,4,6-TNT		171	< 1.92	< 1.92	40.1(104%)
2,6-DNT		< 4.00	< 0.40	< 0.40	6.49(81.1%)
2,4-DNT		< 4.20	< 0.42	< 0.42	7.79(92.7%)

Sample Information	Client ID :	---	---
	RFW#:	100XSS	100XSSD
	D.F.:	1	1
	Units:	Total ug	Total ug
HMX		135(106%)	131(103%)
RDX		110(112%	105(107%)
1,3,5-TNB		226(108%)	213(102%)
1,3-DNB		61.3(104%)	55.4(93.9%)
NITROBENZENE		8.80(21.0%)	6.00(14.3%)
TETRYL		528(106%)	496(99.2%)
2,4,6-TNT		195(102%)	178(9[illegible].2%)
2,6-DNT		40.1(100%)	35.8(89.5%)
2,4-DNT		42.0(100%)	38.5(91.7%)

G=Elevated

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 07-19-89
RFW #: 8907L060, GC/MS SEMIVOLATILE
W.O.#: 2281-08-02

NARRATIVE

The set of samples consisted of three HPLC extracts prepared on 07-28-89.

The samples were analyzed by GC/MS for HSL Semivolatile target compounds on 09-06-89.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

1. The reported results should be considered qualitative only. Concentrations are not reported for the Tentatively Identified Compounds (TIC's).

2. The samples contained a variety of unknowns and a large unresolved complex of hydrocarbons and fatty acids (C14 and greater). Sample FCO-T3-1 contained higher levels than sample AO-T3-1.

Cpn L.
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

9/13/89
DATE

Roy F. Weston, Inc. - Lionville Laboratory
BNA ANALYTICAL DATA PACKAGE FOR
USATHAMA-HWAAP

DATE RECEIVED: 07/19/89

RFW LOT # :8907L060

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
COMP-FCO-EXP-T3-1	048	AI	89LE0826	07/18/89	07/28/89	09/06/89
COMP AO-EXP-T3-1	049	AI	89LE0826	07/17/89	07/28/89	09/06/89
COMP BLK-EXP	052	AI	89LE0826	07/18/89	07/28/89	09/06/89

	Cust ID:	COMP-FCO-EXP -T3-1		COMP AO-EXP-T3-1		COMP BLK-EXP	
Sample	RFW#:	048		049		052	
Information	Matrix:	AIR		AIR		AIR	
	D.F.:	1.00		1.00		1.00	
	Units:	total ug		total ug		total ug	
	Nitrobenzene-d5	NS	%	NS	%	NS	%
Surrogate	2-Fluorobiphenyl	NS	%	NS	%	NS	%
Recovery	p-Terphenyl-d14	NS	%	NS	%	NS	%
	Phenol-d5	NS	%	NS	%	NS	%
	2-Fluorophenol	NS	%	NS	%	NS	%
	2,4,6-Tribromophenol	NS	%	NS	%	NS	%
Phenol		64		3	J	20	U
bis(2-Chloroethyl)ether		20	U	20	U	20	U
2-Chlorophenol		20	U	20	U	20	U
1,3-Dichlorobenzene		20	U	20	U	20	U
1,4-Dichlorobenzene		20	U	20	U	20	U
Benzyl alcohol		20	U	20	U	20	U
1,2-Dichlorobenzene		20	U	20	U	20	U
2-Methylphenol		20	U	20	U	20	U
bis(2-Chloroisopropyl)ether		20	U	20	U	20	U
4-Methylphenol		20	U	20	U	20	U
N-Nitroso-Di-n-propylamine		20	U	20	U	20	U
Hexachloroethane		20	U	20	U	20	U
Nitrobenzene		20	U	20	U	20	U
Isophorone		20	U	20	U	20	U
2-Nitrophenol		20	U	20	U	20	U
2,4-Dimethylphenol		20	U	20	U	20	U
Benzoic acid			R		R	100	U
bis(2-Chloroethoxy)methane		20	U	20	U	20	U
2,4-Dichlorophenol		20	U	20	U	20	U
1,2,4-Trichlorobenzene		20	U	20	U	20	U
Naphthalene		42		15	J	20	U
4-Chloroaniline		20	U	20	U	20	U
Hexachlorobutadiene		20	U	20	U	20	U
4-Chloro-3-methylphenol		20	U	20	U	20	U
2-Methylnaphthalene		11	J	20	U	20	U
Hexachlorocyclopentadiene		20	U	20	U	20	U

*= Outside of EPA CLP QC limits.

Cust ID:	COMP-PCO-EXP -T3-1		COMP AO-EXP- T3-1		COMP BLK-EXP	
RFW#:	046		049		052	
2,4,6-Trichlorophenol	20	U	20	U	20	U
2,4,5-Trichlorophenol	100	U	100	U	100	U
2-Chloronaphthalene	20	U	20	U	20	U
2-Nitroaniline	100	U	100	U	100	U
Dimethylphthalate	20	U	20	U	20	U
Acenaphthylene	20	U	20	U	20	U
2,6-Dinitrotoluene	20	U	20	U	20	U
3-Nitroaniline	100	U	100	U	100	U
Acenaphthene	20	U	20	U	20	U
2,4-Dinitrophenol	100	U	100	U	100	U
4-Nitrophenol	100	U	100	U	100	U
Dibenzofuran	20	U	20	U	20	U
2,4-Dinitrotoluene	270		20	U	20	U
Diethylphthalate	20	U	140		4	J
4-Chlorophenyl-phenylether	20	U	20	U	20	U
Fluorene	20	U	20	U	20	U
4-Nitroaniline	100	U	100	U	100	U
4,6-Dinitro-2-methylphenol	100	U	100	U	100	U
N-Nitrosodiphenylamine (1)	20	U	20	U	20	U
4-Bromophenyl-phenylether	20	U	20	U	20	U
Hexachlorobenzene	20	U	20	U	20	U
Pentachlorophenol	100	U	100	U	100	U
Phenanthrene	20	U	20	U	20	J
Anthracene	20	U	20	U	20	U
Di-n-Butylphthalate	82		68		7	J
Fluoranthene	20	U	20	U	20	U
Pyrene	20	U	20	U	20	U
Butylbenzylphthalate	20	U	5	J	2	J
3,3'-Dichlorobenzidine	40	U	40	U	40	U
Benzo(a)anthracene	20	U	20	U	20	U
Chrysene	20	U	20	U	20	U
bis(2-Ethylhexyl)phthalate	29		40		11	J
Di-n-Octyl phthalate	2	J	4	J	20	U
Benzo(b)fluoranthene	20	U	20	U	20	U
Benzo(k)fluoranthene	20	U	20	U	20	U
Benzo(a)pyrene	20	U	20	U	20	U
Indeno(1,2,3-cd)pyrene	20	U	20	U	20	U
Dibenzo(a,h)anthracene	20	U	20	U	20	U
Benzo(g,h,i)perylene	20	U	20	U	20	U

(1) - Cannot be separated from Diphenylamine. *= Outside of EPA CLP QC limits.

1F

SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

COMP-PCO-EXP-T3-1

Lab Name: Roy F. Weston, Inc. Work Order: 2281-08-02-0000

Client: USATHAMA-SWRAP

Matrix: AIR

Lab Sample ID: 8907L060-048

Sample wt/vol: ______ (g/mL) __

Lab File ID: S090603

Level: (low/med) LOW

Date Received: 07/19/89

% Moisture: not dec. ______ dec.

Date Extracted: 07/28/89

Extraction: (SepF/Cont/Sonc) ____

Date Analyzed: 09/06/89

GPC Cleanup: (Y/N) N pH: ______

Dilution Factor: 1.00

Number TICs found: 22

CONCENTRATION UNITS:
(ug/L or ug/Kg) total ug

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	TNT	16.35	NA	
2.	TNT	16.83	NA	
3.	UNKNOWN	18.18	NA	
4.	FATTY ACID	18.60	NA	
5.	PHTHALATE	18.73	NA	
6.	UNKNOWN	19.00	NA	
7.	UNKNOWN	19.17	NA	
8.	FATTY ACID	19.58	NA	
9.	UNKNOWN	19.65	NA	
10.	UNKNOWN	19.72	NA	
11.	UNKNOWN	19.85	NA	
12.	FATTY ACID	2 NAO	NA	
13.	UNKNOWN	20.17	NA	
14.	UNKNOWN	20.37	NA	
15.	UNKNOWN	21.03	NA	
16.	UNKNOWN	21.33	NA	
17.	UNKNOWN	21.45	NA	
18.	ALKANE	22.03	NA	
19.	UNKNOWN	22.58	NA	
20.	ALKANE	24.83	NA	
21.	UNKNOWN	25.38	NA	
22.	UNKNOWN	25.77	NA	

1F
SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

COMP AO-EXP-T3-1

Lab Name: Roy F. Weston, Inc. Work Order: 2281-08 [illegible]-0000

Client: [illegible]-SWAAP

Matrix: AIR Lab Sample ID: 3907L060-049

Sample wt/vol: ______ (g/mL) __ Lab File ID: 3090604

Level: (low/med) LOW Date Received: 07/19/89

% Moisture: not dec. ______ dec. Date Extracted: 07/28/89

Extraction: (SepF/Cont/Sonc) ____ Date Analyzed: 09/06/89

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.00

CONCENTRATION UNITS:
Number TICs found: 21 (ug/L or ug/Kg) total ug

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	6.82	NA	
2.	UNKNOWN	7.28	NA	
3.	C4 BENZENE	7.72	NA	
4.	UNKNOWN	8.95	NA	
5.	UNKNOWN	9.23	NA	
6.	UNKNOWN	10.25	NA	
7.	UNKNOWN	10.43	NA	
8.	BENZAMIDE	11.38	NA	
9.	ETHYLBENZOIC ACID	11.55	NA	
10.	ETHYLBENZOIC ACID	11.72	NA	
11.	UNKNOWN	17.38	NA	
12.	FATTY ACID	18.50	NA	
13.	UNKNOWN	19.32	NA	
14.	UNKNOWN	19.90	NA	
15.	FATTY ACID ESTER	19.98	NA	
16.	UNKNOWN	21.47	NA	
17.	UNKNOWN	22.18	NA	
18.	UNKNOWN	22.32	NA	
19.	UNKNOWN	23.15	NA	
20.	UNKNOWN	24.47	NA	
21.	UNKNOWN	25.37	NA	

1F
SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

COMP BLK-EXP

Lab Name: Roy F. Weston, Inc. Work Order: 2281-08-02-0000

Client: CHATTAHA-SWAAP

Matrix: AIR

Lab Sample ID: 8907L060-052

Sample wt/vol: ____ (g/mL) __

Lab File ID: 3090603

Level: (low/med) LOW

Date Received: 07/19/89

% Moisture: not dec. ____ dec.

Date Extracted: 07/28/89

Extraction: (SepF/Cont/Sonc) ____

Date Analyzed: 09/06/89

GPC Cleanup: (Y/N) N pH: ____

Dilution Factor: 1.00

Number TICs found: 12

CONCENTRATION UNITS:
(ug/L or ug/Kg) total ug

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	14.20	NA	
2.	UNKNOWN	19.77	NA	
3.	UNKNOWN	22.53	NA	
4.	UNKNOWN	23.40	NA	
5.	UNKNOWN	23.48	NA	
6.	UNKNOWN	23.65	NA	
7.	UNKNOWN	23.73	NA	
8.	UNKNOWN	23.82	NA	
9.	UNKNOWN	23.93	NA	
10.	UNKNOWN	24.45	NA	
11.	UNKNOWN	24.48	NA	
12.	UNKNOWN	24.78	NA	

STACK TEST 5

500°F/24 HOURS

ANALYTICAL DATA SUMMARY

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-19, 20, 8-1
RFW#: 3907L060,073,158, 187
3908L202
W.O.#: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All preparation blanks were analyzed below the required detection limit.

3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.

5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/24/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/15/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8903L202

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-003	UH-FCO-PART-BHW T5-1	NITRATED ESTERS	17300		UG	1120
-004	UH-FCO-PART-BHA T5-1	NITRATED ESTERS	6050		UG	950
-005	UH-FCO-PART-FHA T5-1	PARTICULATE	0.0043		grams	0.0000
-006	UH-AO-PART-FILT T5-1	PARTICULATE	0.0015		grams	0.0000
-007	UH-AO-PART-BHW T5-1	NITRATED ESTERS	2240		UG	1550
-008	UH-AO-PART-BHA T5-1	NITRATED ESTERS	288	u	UG	288
-023	UH-FCO-PART-BHW T5-2	NITRATED ESTERS	1340		UG	1180
-024	UH-FCO-PART-BHA T5-2	NITRATED ESTERS	238	u	UG	238
-025	UH-AO-PART-FHA T5-2	PARTICULATE	0.0025		grams	0.0000
-026	UH-AO-PART-FILT T5-2	PARTICULATE	0.0005		grams	0.0000
-027	UH-AO-PART-BHW T5-2	NITRATED ESTERS	1820	u	UG	1820
-028	UH-AO-PART-BHA T5-2	NITRATED ESTERS	750	u	UG	750
-029	UH-BLK TRAIN FHA T5-	PARTICULATE	0.0007		grams	0.0000
-030	UH BLK TRAIN BHAT5-	PARTICULATE	0.0001		grams	0.0000
-031	UHBLK TRAIN BHW T5-2	NITRATED ESTERS	688	u	UG	688
-032	UHBLK TRAIN BHA T5-2	NITRATED ESTERS	225	u	UG	225
-047	UH-FCO-PART-BHW T5-3	NITRATED ESTERS	4060		UG	1080
-048	UH-FCO-PART-BHA T5-3	NITRATED ESTERS	462	u	UG	462
-049	UH-AO-PART-FHA T5-3	PARTICULATE	0.0016		grams	0.0000
-050	UH-AO-PART-FILT T5-3	PARTICULATE	0.0000		grams	0.0000

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/15/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-051	UH-AO-PART-BHW T5-3	NITRATED ESTERS	1220	u	UG	1220
-052	UH-AO-PART-BHA T5-3	NITRATED ESTERS	138	u	UG	138
-065	COMP-FLO-PT-T5-1	NITRATED ESTERS	5.0	u	UG	5.
-066	COMP-AO-PT-T5-1	NITRATED ESTERS	5.0	u	UG	5.
-069	COMP FLO-PT-T5-2	NITRATED ESTERS	5.0	u	UG	5.
-070	COMP AO-PT-T5-2	NITRATED ESTERS	5.0	u	UG	5.
-071	COMP-BT-PT	NITRATED ESTERS	5.0	u	UG	5.
-074	COMP FLO-PT-T5-3	NITRATED ESTERS	5.0	u	UG	5.
-075	COMP AO-PT-T5-3	NITRATED ESTERS	5.0	u	UG	5.

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 8908L202

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u	MG/L	2.5
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/15/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8908L2[illegible]

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.3	2.5 u	10.0	10[illegible]
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	[illegible]
		NITRATED ESTERS	49.5	2.5 u	50.0	99

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 8902L202

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	69LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 03-01-89
RFW #: 8907L202, Air
W.O.#: 2231-08-04

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil , modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation		Description
BLK	=	Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS	=	Designates sample spiked with target compound.
SSD	=	Designates sample spiked with target compound in duplicate.
D	=	Indicates duplicate analysis of a sample.
NS	=	Not spiked.
DL	=	Diluted below calibration range.
G	=	Indicates elevated detection limit due to sample interference.
NR	=	Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Results for T5-1 FCO represent a minimum value as the front half XAD sample was broken during sample preparation. Observations indicate that the majority of explosives have been contained in the front half solvent rinse for Hawthorne MM-5 explosives in air samples.

Data Qualifiers

<	=	Less than
>	=	Greater than

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

Analysis Summary:

Samples Collected: 07-29,30-89
Samples Prepared: 08-02-89
Samples Analyzed: 08-10-89

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8/21/89
DATE

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L202 CLIENT: USATHAMA-HAWTHORNE

Sample Information	Client ID :	T5-1	T5-1	T5-2	T5-2	T5-3	T5-3
		FCO	FCO	FCO	AO	FCO	AO
	RFW#:	67	68	72	73	76	77
	D.F.:	1875	1	100	1	10	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 2380	12.7G	< 127	1.47G	< 12.7	< 1.27
RDX		< 1840	2.76G	< 98.0	2.57G	< 9.80	2.84G
1,3,5-TNB		< 3920	< 2.09	< 209	2.19G	< 20.9	7.62G
1,3-DNB		< 1110	2.63G	< 59.0	7.60G	< 5.90	1.90G
NITROBENZENE		< 788	< 0.42	< 42.0	1.56G	< 4.20	1.91G
TETRYL		< 9380	< 5.00	< 500	< 5.00	< 50.0	< 5.00
2,4,6-TNT		76,800	< 1.92	677	< 1.92	184	< 1.92
2,6-DNT		< 750	< 0.40	< 40	< 0.40	< 4.00	< 0.40
2,4-DNT		< 780	< 0.42	< 42	< 0.42	< 4.20	< 0.42

Sample Information	Client ID :	---	---	---	---
	RFW#:	BLANK	20XSS	100XSS	100XSSD
	D.F.:	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug
HMX		< 1.27	24.2(95.3%)	126(99.2%)	126(99.2%)
RDX		< 0.98	20.2(103%)	106(108%)	108(110%)
1,3,5-TNB		< 2.09	43.6(104%)	230(110%)	233(111%)
1,3-DNB		< 0.59	8.32(70.5%)	57.9(98.1%)	54.4(92.2%
NITROBENZENE		< 0.42	< 0.42(0.0%)	< 0.42(0.0%)	< 0.42(0.0%)
TETRYL		< 5.00	102(102%)	565(113%)	582(116%)
2,4,6-TNT		< 1.92	39.4(103%)	215(112%)	213(111%)
2,6-DNT		< 0.40	4.78(59.8%)	37.6(94.0%)	33.2(83.0%
2,4-DNT		< 0.42	6.40(76.1%)	43.5(104%)	42.2(100%)

G=Elevated

APPENDIX H

ANALYTICAL DATA SUMMARY TABLES FOR TEST ITEMS

COMPUTER GENERATED ANALYTICAL DATA SUMMARY TABLES

Appendix H contains computer-generated analytical data summary tables. The tables have been prepared for pre-test and post-test sampling events.

The tables provide the following information:

- Equipment (test item) type.
- Sample matrix (wipe, rinsate or solid).
- Units.
- Contaminant mass or concentration.
- Total explosives concentration (sum of individual explosives contaminants (excludes nitrocellulose and nitroglycerin)).

A key of the sample identification conventions is provided in Table H-1.

Sample results exceeding the method detection limit (or estimated as J values) are shown in bold print.

If the analysis indicated that the compound was present below the method detection limit, the detection limit is shown with the classification U (e.g., 635U signifies that the contaminant was not present above the detection level of 635 ug).

Detection limits vary by matrix and dilution factor. In some cases, if the TNT concentration in a particular sample was high, a dilution was required to bring the concentration within the calibration range. The detection limits for the remainder of explosives analytes (e.g., tetryl) were increased proportionately.

In some cases, the mass of some contaminants is shown as a "J" value (i.e., 3.36J). This indicates that the compound was determined to be present but below the detection level. The value is estimated.

The presence of nitrobenzene in many of the wipe samples is attributable to field/laboratory contamination as discussed in Section 8 of the main report. Table 8-9 summarizes all of the nitrobenzene results.

The concentrations of some contaminants, specifically TNT in the sediment from the clay pipe, are reported as over one million parts per million (e.g., for pre-Test 15 samples, the concentration of TNT is reported as 1,246,000 ug/g). This anomaly is due to the reporting procedure. Concentrations are reported

Table H-1

Sample Identification Conventions

U	-	Below Detection Limit
J	-	Estimated Concentration
ug	-	Microgram
CP	-	Clay Pipe
PB	-	Powder Box
SM	-	Ship Mine
SSR	-	Shell Support Rack
SP	-	Steel Pipe
AP	-	Aluminum Pipe
CHMB WALL	-	Flash Chamber Wall
SHR	-	Steam-Heated Riser
SHV	-	Steam-Heated Valve
FLD BLNK	-	Field Blank
R	-	Rinsate Sample
W	-	Wipe Sample
SPK	-	Spike Applicator
DUP	-	Duplicate
S	-	Spike Rinsate

as weight of TNT to weight of soil. Apparently, in this case, if the weight of TNT exceeded the weight of soil, the concentration is over 100 percent, as shown for the following hypothetical case:

- Initial TNT mass - 100 grams
- Initial soil mass - 50 grams
- Concentration (ppm) = mass TNT/mass soil x 100%
  = 100 grams/50 grams x 100%
  = 200%

TEST RUN 2
400°F/24 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 2 - 450 Deg F, 24 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	TOTAL [illegible]
MOTOR SOAK	RINSE	Total ug	[illegible] U	[illegible]	115000 U	31800 U	22700 U	270000 U	[illegible]	21600 U	[illegible]	[illegible]
PB 1	RINSE	Total ug	635 U	400 U	1030 U	295 U	210 U	2500 U	960 U	200 U	210 U	0
PB 2	RINSE	Total ug	633 U	400 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	0
SSR 1	WIPE	Total ug	12.7 U	9.8 U	20.9 U	5.90 U	8.43	50.0 U	470	4.00 U	4.20 U	478
SSR 1 SPK	RINSE	Total ug	13300 U	[illegible] U	22000 U	6200 U	4410 U	62500 U	131000	4200 U	4410 U	[illegible]
SSR 1 DECON	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	8.70	50.0 U	19.2 U	4.00 U	4.20 U	8.70
SSR 2	WIPE	Total ug	12.7 U	9.30 U	20.9 U	5.90 U	4.10	50.0 U	19.2 U	4.00 U	4.20 U	4.10
SSR 2 SPK	RINSE	Total ug	3500 U	2740 U	[illegible] U	1850 U	1180 U	14000 U	141000	1120 U	1180 U	141000
SSR 2 DECON	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	6.60	50.0 U	19.2 U	4.00 U	4.20 U	6.60

HWAAP - Hot Gas Pilot Study
Post Test 2 - 400 Deg F, 24 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CHMB WALL	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	15.8	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	[illegible]
CLAY PIPE	SOIL	ug/g	1.27 U	0.960 U	2.09 U	0.560 U	0.420 U	5.00 U	1.92 U	0.400 U	0.420 U	N/A (1)	0
FIELD BLANK	RINSE	Total ug	12.1 U	9.31 U	20.0 U	5.61 U	3.99 U	47.5 U	18.2 U	3.80 U	3.99 U	N/A (1)	0
PB 1 R1	RINSE	Total ug	635 U	480 U	1050 U	266 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R2	RINSE	Total ug	635 U	480 U	1050 U	265 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R3	RINSE	Total ug	635 U	480 U	1050 U	236 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R4	RINSE	Total ug	635 U	400 U	1050 U	265 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHIP MINE W1	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	12.8	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	12.8
SHIP MINE	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	8.31	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.31
SHR 1 R1	RINSE	Total ug	191 U	147 U	315 U	83.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	RINSE	Total ug	191 U	147 U	315 U	83.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	RINSE	Total ug	191 U	147 U	6.840 J	83.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	RINSE	Total ug	191 U	147 U	0.806 J	83.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHV 1 R1	RINSE	Total ug	635 U	480 U	1050 U	265 U	210 U	2500 U	1300	200 U	210 U	N/A (1)	1300
SHV 1 R2	RINSE	Total ug	635 U	480 U	1050 U	265 U	210 U	2500 U	2700	200 U	210 U	N/A (1)	2700
SHV 1 R3	RINSE	Total ug	635 U	480 U	1050 U	265 U	210 U	2500 U	3400	200 U	210 U	N/A (1)	3400
SHV 1 R4	RINSE	Total ug	635 U	480 U	1050 U	275 U	210 U	2500 U	2200	200 U	210 U	N/A (1)	2200
SSR 1 W1BOT	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	8.83	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.83
SSR 1 W1TOP	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	13.3	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	13.3
SSR 1 W2BOT	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	20.1	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	20.1
SSR 1 W2TOP	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	8.40	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.40
SSR 1 W3BOT	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	17.9	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	17.9
SSR 1 W3TOP	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	17.8	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	17.8
SSR 1 W4BOT	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	15.9	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	15.9
SSR 1 W4TOP	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	15.1	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	15.1
S2	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.00 U	34.1	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	34.1
WIPE BLANK	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.60 U	5.22	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	5.22
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed (2) - Explosives Compounds not Analyzed

TEST RUN 3
500°F/36 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 3 - 500 Deg F, [illegible] Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CHMB WALL	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	18.1	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	18.1
CLAY PIPE	SOIL	ug/g	12700 U	9600 U	20900 U	5900 U	4200 U	50000 U	163000	4000 U	4200 U	N/A (1)	163000
PB 1 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB PRE WIPE	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHP MINE W1	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	8.50	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.50
SHR 1 R1	RINSE	Total ug	190.5 U	337	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	337
SHR 2 R1	RINSE	Total ug	190.5 U	236	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	236
SHV 1 R1	RINSE	Total ug	1430	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	41600	N/A (1)	[illegible]
SHV 1 R1	RINSE	Total ug	6350 U	4900 U	10500 U	2950 U	2100 U	25000 U	9600 U	2000 U	2100 U	N/A (1)	0
SHV 1 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	8100	N/A (1)	8100
SHV 2 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	[illegible]	N/A (1)	[illegible]
SHV 2 R1	RINSE	Total ug	6350 U	4900 U	10500 U	2950 U	2100 U	25000 U	9600 U	2000 U	[illegible]	N/A (1)	[illegible]
SHV 2 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	1700	N/A (1)	1700
SHV 2 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SM RE-WIPE 3	WIPE	ug	12.7 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 DECON	WIPE	Total ug	21.4	25.6	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	47.0
SSR 1 SPK	RINSE	Total ug	19100 U	14700 U	31500 U	8850 U	6300 U	75000 U	[illegible]	6000 U	6300 U	N/A (1)	[illegible]

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Pre Test 3 - 600 Deg F, 36 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
SSR 1 W1	WIPE	Total ug	127 U	9.60 U	20.9 U	5.90 U	6.60	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	6.60
SSR 1 W1	WIPE	Total ug	644	658	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	1300
SSR 1 W2	WIPE	Total ug	460	9.60 U	20.9 U	5.90 U	8.10	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	468
SSR 1 W2	WIPE	Total ug	127 U	720	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	720
SSR 1 W3	WIPE	Total ug	269	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	24.4	4.00 U	4.20 U	N/A (1)	293
SSR 1 W3	WIPE	Total ug	127 U	493	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	493
SSR 1 W4	WIPE	Total ug	181	311	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	492
SSR 1 W5	WIPE	Total ug	127 U	685	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	685
SSR 1 W5	WIPE	Total ug	268	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	48.1	4.00 U	4.20 U	N/A (1)	316
SSR 2 DECON	WIPE	Total ug	25.6	76.2	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.0 U	4.20 U	N/A (1)	102
SSR 2 SPK	RINSE	Total ug	16500 U	12700 U	27300 U	7670 U	5460 U	65000 U	133000	5200 U	5460 U	N/A (1)	133000
SSR 2 W1	WIPE	Total ug	513	9.60 U	20.9 U	5.90 U	7.20	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	520
SSR 2 W1	WIPE	Total ug	127 U	678	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	678
SSR 2 W2	WIPE	Total ug	305	467	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	782
SSR 2 W3	WIPE	Total ug	221	418	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	639
SSR 2 W4	WIPE	Total ug	157	327	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	484
SSR 2 W5	WIPE	Total ug	149	284	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	433
SHP [illegible] W2	WIPE	ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	10.0 U	0
CHRB [illegible] W	WIPE	ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	10.0 U	0

(1) - Nitrocellulose and Nitroglycerine not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWA[illegible] Pilot Study
Post Test 3 – [illegible] Deg F, 3[illegible] Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-[illegible]	[illegible]	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
[illegible]	SOIL	ug/g	1.27 U	0.[illegible] U	2.0[illegible] U	0.[illegible] U	0.420 U	5.0[illegible] U	1.[illegible] U	0.400 U	0.420 U	N/A (1)	0
[illegible] 1 R1	RINSE	Total ug	635 U	400 U	[illegible]	265 U	210 U	2500 U	[illegible]	2[illegible] U	210 U	N/A (1)	0
[illegible] 1 R2	RINSE	Total ug	635 U	400 U	1050 U	265 U	210 U	2500 U	[illegible]	200 U	210 U	N/A (1)	0
PB 1 R3	RINSE	Total ug	635 U	400 U	[illegible]	265 U	210 U	2500 U	[illegible]	200 U	210 U	N/A (1)	0
PB 1 R4	RINSE	Total ug	635 U	400 U	[illegible]	[illegible]	210 U	2500 U	[illegible]	200 U	210 U	N/A (1)	0
PB W1	WIPE	Total ug	12.7 U	9.80 U	[illegible]	[illegible]	20.6	50.0 U	[illegible]	[illegible]	4.20 U	N/A (1)	[illegible]
SHIP [illegible] W1	WIPE	Total ug	12.7 U	9.80 U	[illegible]	[illegible]	18.3	50.0 U	19.2 U	4.50 U	4.2[illegible] U	N/A (1)	[illegible]
SHR 1 R1	RINSE	Total ug	191 U	147 U	[illegible]	[illegible]	63.0 U	[illegible]	26[illegible] U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R1 DUP	RINSE	Total ug	191 U	147 U	[illegible]	[illegible]	63.0 [illegible]	[illegible]	25[illegible] U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	RINSE	Total ug	191 U	147 U	[illegible]	88.5 U	[illegible]	[illegible]	[illegible]	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2 DUP	RINSE	Total ug	101 U	147 U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	RINSE	Total ug	191 U	147 U	315 U	88.5 U	[illegible]	75[illegible] U	253 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3 DUP	RINSE	Total ug	191 U	147 U	315 U	[illegible]	[illegible]	[illegible]	26[illegible] U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	RINSE	Total ug	191 U	147 U	315 U	[illegible]	[illegible]	[illegible]	729	60.0 U	63.0 U	N/A (1)	[illegible]
SHR 1 R4 DUP	RINSE	Total ug	191 U	147 U	315 U	[illegible]	[illegible]	[illegible] U	2,[illegible]	60.0 U	63.0 U	N/A (1)	[illegible]
SHR 1 R5	[illegible]	Total ug	191 U	147 U	315 U	[illegible]	[illegible]	750 U	263 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R6	RI[illegible]	Total ug	191 U	147 U	315 U	[illegible]	[illegible]	750 U	263 U	60.0 U	63.0 U	N/A (1)	0

(1) - Nitrated Esters not Analyzed.

[illegible] Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 3 - 600 Deg F, 36 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
SHR 2 R1	RINSE	Total ug	191 U	147 U	315 U	68.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 2 R2	RINSE	Total ug	191 U	147 U	315 U	68.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 2 R3	RINSE	Total ug	191 U	147 U	315 U	68.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 2 R4	RINSE	Total ug	191 U	147 U	315 U	68.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 2 R5	RINSE	Total ug	191 U	147 U	315 U	68.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 2 R6	RINSE	Total ug	191 U	147 U	315 U	68.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHV 1 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHV 1 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHV 1 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHV 1 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SSR 1 W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	10.7	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	10.7
SSR 1 W2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	9.87	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	9.67
SSR 1 W3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	8.69	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.69
SSR 1 W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	8.83	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.83
SSR 1 W5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	12.0	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	12.0
SSR 1 W6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	14.7	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	14.7
SSR 1 W7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	13.9	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	13.9
SSR 1 W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	8.23	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.23
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.0 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

TEST RUN 5
500°F/24 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 5 - 500 Deg F, 24 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CLAY PIPE	SOIL	ug/g	12700 U	[illegible] U	[illegible] U	5500 U	4200 U	50000 U	[illegible]	4000 U	4200 U	N/A (1)	[illegible]
GEAR OIL	OIL	ug/g	144 U	2130	237 U	63.3 U	47.6 U	562 U	217 U	45.3 U	47.6 U	N/A (1)	2130
PB 1 R1/R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R1/R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHIP MINE W1	WIPE	Total ug	43.9	9.80 U	20.9 U	5.77 J	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	43.9
SHIP MINE W1	WIPE	Total ug	127 U	98.0 U	209 U	59.0 U	42.00 U	500 U	192 U	40.0 U	133	N/A (1)	133
SSR 1 SPK	RINSE	Total ug	7840 U	6130 U	13100 U	3600 U	2630 U	31300 U	403000	2500 U	2630 U	N/A (1)	403000
SSR 1 TOP W	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W1/W4	WIPE	Total ug	209	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	5.78	N/A (1)	215
SSR 1 W1/W4'	WIPE	Total ug	127 U	637	209 U	59.00 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	637
SSR 2 SPK	RINSE	Total ug	12700 U	9800 U	21000 U	5900 U	4200 U	50000 U	348000	4000 U	4200 U	N/A (1)	348000
SSR 2 TOP W	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 2 W1/W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SP BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.58	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	4.58
SP BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHIP MINE W2	WIPE	ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SM FLD BLNK	WIPE	ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 5 - 500 Deg F, 24 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CHMB WALL	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	17.6	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	17.6
CHMB WALL BL	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	8.29	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.29
CLAY PIPE	SOIL	ug/g	1.27 U	0.980 U	2.09 U	0.590 U	0.42 U	5.00 U	1.92 U	0.400 U	0.420 U	N/A (1)	0
CP FLD BLNK	RINSE	Total ug	63.5 U	73.5 U	157.5 U	44.3 U	31.5 U	375 U	144 U	30.0 U	31.5 U	N/A (1)	0
MOTOR RINSE	RINSE	Total ug	85050 U	51000 U	105000 U	30700 U	21800 U	250000 U	99800 U	20600 U	21000 U	N/A (1)	0
PB 1 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	114 U	88.2 U	189 U	53.1 U	37.8 U	450 U	172.8 U	36.0 U	37.8 U	N/A (1)	0
SHIP MINE W1	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	20.1	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	20.1
SHR 1 R1	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR FLD BLNK	RINSE	Total ug	63.5 U	73.5 U	158 U	44.3 U	31.5 U	375 U	144 U	30.0 U	31.5 U	N/A (1)	0
SSR 2 W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	24.2	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	24.2
SSR 2 W2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	7.24	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	7.24
SSR 2 W3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.94	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	4.94
SSR 2 W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	3.02 J	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 2 W5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	25.6	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	25.6
SSR 2 W6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	8.71	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	8.71
SSR 2 W7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.84	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	4.84
SSR 2 W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	3.06 J	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.50	0

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

TEST RUN 3
400°F/36 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 8 - 400 Deg F, 36 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CLAY PIPE	SOIL	ug/g	1270 U	[illegible] U	2000 U	500 U	430 U	5000 U	[illegible]	400 U	420 U	N/A (1)	[illegible]
CP FLD BLNK	RINSE	Total ug	57.2 U	44.1 U	94.5 U	27.0 U	18.9 U	225 U	86.4 U	18.0 U	18.9 U	N/A (1)	0
PB 1 R1/R4	RINSE	Total ug	635 U	460 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R1/R4	RINSE	Total ug	635 U	460 U	1050 U	295 U	210 U	2500 U	930 U	200 U	210 U	N/A (1)	0
SHIP LINE W1	WIPE	Total ug	62.9	9.60 U	20.9 U	21.1	7.30	51	34.9	4.00 U	4.20 U	N/A (1)	17[illegible]
SHIP LINE W1	WIPE	Total ug	1270 U	930 U	2000 U	590 U	420 U	5000 U	1920 U	400 U	[illegible]	N/A (1)	[illegible]
SH FLD BLNK	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	4.94	50 U	19.2 U	4.00 U	4.20 U	N/A (1)	4.94
SSR 1 SPK	RINSE	Total ug	19700 U	15200 U	32500 U	9145 U	6510 U	77500 U	211000	6200 U	6510 U	N/A (1)	211[illegible]
SSR 1 W1/W4	WIPE	Total ug	9.12 J	28.6	20.9 U	5.90 U	18.7	50 U	19.2 U	4.00 U	4.20 U	N/A (1)	47.2
SSR 1 W5/W8	WIPE	Total ug	580	9.60 U	20.9 U	5.90 U	19.7	50 U	148	4.00 U	4.20 U	N/A (1)	72[illegible]
SSR 1 W5/W8	WIPE	Total ug	127 U	1470	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	1470
SSR 2 SPK	RINSE	Total ug	19700 U	15200 U	32500 U	9150 U	6510 U	77500 U	207700	6200 U	6510 U	N/A (1)	[illegible]
SSR 2 W1/W4	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	34.3	50 U	19.2 U	4.00 U	4.20 U	N/A (1)	3[illegible]3
SSR 2 W5/W8	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	38.8	50 U	42.8	4.00 U	4.20 U	N/A (1)	7[illegible]
SP WAX	RINSE	Total ug	197 U	152 U	328 U	91.5 U	65.1 U	775 U	297.6 U	62.0 U	65.1 U	N/A (1)	0
SP WAX	RINSE	Total ug	1970 U	1520 U	3280 U	915 U	651 U	7750 U	10[illegible]	620 U	651 U	N/A (1)	1[illegible]
SHIP LINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	13.0	N/A (2)
SH FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	2.65	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 8 - 400 Deg F, 36 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
SSR 1 W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SP R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	7.50	N/A (2)
SHIP LINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	8.3	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 8 - 400 Deg F, 36 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
BEAKER RINSE	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	825 U	240 U	50.0 U	52.5 U	N/A (1)	0
CHMB WALL	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CHMB WALL BL	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CLAY PIPE	SOIL	ug/g	1.27 U	0.980 U	2.09 U	0.590 U	0.420 U	5.00 U	6.03	0.400 U	0.420 U	N/A (1)	6.03
CP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	825 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 1 R1 DUP	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	1260	200 U	210 U	N/A (1)	1260
PB 1 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHP MINE W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHR 1 R1	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR FLD BLNK	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Components not Analyzed.

TEST RUN 13
500°F/12 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 13 - 600 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
AP 1	RINSE	Total ug	1550 U	1230 U	[illegible]	738 U	525 U	[illegible]	2400 U	500 U	1440	N/A (1)	[illegible]
AP 1'	RINSE	Total ug	15500 U	12300 U	[illegible]	7380 U	5250 U	62500 U	[illegible]	5000 U	5250 U	N/A (1)	[illegible]
AP 2	RINSE	Total ug	1590 U	1230 U	2630 U	738 U	525 U	6250 U	2400 U	500 U	678	N/A (1)	678
AP 2'	RINSE	Total ug	15900 U	12300 U	26300 U	7380 U	5250 U	62500 U	723000	5000 U	5250 U	N/A (1)	[illegible]
CLAY PIPE	SOIL	ug/g	12700 U	9600 U	20000 U	6300 U	4200 U	50000 U	845000	4000 U	4200 U	N/A (1)	[illegible]
CP FLD BLNK	RINSE	Total ug	152 U	118 U	252 U	70.8 U	50.4 U	600 U	230.4 U	48.0 U	50.4 U	N/A (1)	0
PB 1 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	[illegible]	200 U	210 U	N/A (1)	0
PB 2 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	150 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHIP MINE W1	WIPE	Total ug	37.7	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	43.7	N/A (1)	104.4
SSR 1 SPK	RINSE	Total ug	24600 U	19100 U	41000 U	11500 U	8190 U	97500 U	362000	7600 U	8190 U	N/A (1)	[illegible]
SSR 1 W1/W4	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W5/W8	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	3.33 J	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 2 SPK	RINSE	Total ug	2290 U	1790 U	3760 U	1060 U	756 U	9000 U	[illegible]	720 U	756 U	N/A (1)	[illegible]
SSR 2 W1/W4	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.00 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 2 W5/W8	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.00 U	8.25	50.0 U	19.2 U	4.00 U	[illegible]	N/A (1)	8.25
SSR FLD BLNK	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	2.94 J	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	12.5	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 13 - 500 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,3-DNT	2,4-DNT	NITRATED Esters	TOTAL Explosives
AP R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
AP R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
AP R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
AP R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
CHMB WALL	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CHMB WALL BL	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CLAY PIPE	SOIL	ug/g	1.27 U	0.980 U	2.09 U	0.590 U	0.420 U	5.00 U	1.74 J	0.400 U	0.420 U	N/A (1)	0
CP FLD. BLNK	RINSE	Total ug	159 U	123 U	263 U	73.75 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 2 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB FLD. BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHIP MINE W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHR 1 R1	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR FLD BLNK	RINSE	Total ug	185 U	127 U	273 U	78.7 U	54.6 U	650 U	250 U	52.0 U	54.6 U	N/A (1)	0
SSR 1 W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	17.4 J	4.00 U	4.20 U	N/A (1)	0
SSR 1 W7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	7.50	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

--- Removal Efficiency Not Calc

TEST RUN 14
400°F/12 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 14 - 400 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CLAY PIPE	SOIL	ug/g	12700 U	6800 U	20000 U	5000 U	4200 U	50000 U	884000	4000 U	4200 U	N/A (1)	884000
CP FLD. BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB FLD. BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHP MINE W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SH FLD. BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 SPK	RINSE	Total ug	1588 U	1230 U	2630 U	733 U	525 U	6250 U	201000	500 U	188	N/A (1)	201000
SSR 1 SPK	RINSE	Total ug	15900 U	12300 U	26300 U	7380 U	5250 U	62500 U	843000	5000 U	5250 U	N/A (1)	843000
SSR 1 SPK	RINSE	Total ug	19100 U	14700 U	31600 U	8850 U	6300 U	75000 U	28800 U	6000 U	6300 U	N/A (1)	0
SSR 1 W1/W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	18.9	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	18.9
SSR 1 W5/W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	16.6	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	16.6
SSR 2 SPK	RINSE	Total ug	19100 U	14700 U	31500 U	8850 U	6300 U	75000 U	348000	6000 U	6300 U	N/A (1)	348000
SSR 2 SPK	RINSE	Total ug	1590 U	1230 U	2630 U	738 U	525 U	6250 U	365000	500 U	445	N/A (1)	[illegible]
SSR 2 SPK	RINSE	Total ug	15900 U	12300 U	26300 U	7380 U	5250 U	62500 U	24000 U	5000 U	5250 U	N/A (1)	0
SSR 2 W1/W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	25.4	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	25.4
SSR 2 W5/W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SH FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAF - Hot Gas Pilot Study
Post Test 14 - 400 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CHMB. WALLS	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CLAY PIPE	SOIL	ug/g	1.27 U	0.980 U	2.09 U	0.590 U	0.420 U	5.00 U	1.92 U	0.400 U	0.420 U	N/A (1)	0
CP FLD. BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB FLD. BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHIP MINE W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHR 1 R1	RINSE	Total ug	732	6340	669	68.5 U	63.0 U	750 U	8190	60.0 U	166	N/A (1)	[illegible]
SHR 1 R2	RINSE	Total ug	720	6370	672	88.5 U	63.0 U	750 U	8450	60.0 U	118	N/A (1)	[illegible]
SHR 1 R3	RINSE	Total ug	450	2600	338	88.5 U	63.0 U	750 U	6100	60.0 U	[illegible]	N/A (1)	[illegible]
SHR 1 R4	RINSE	Total ug	284	840	315 U	88.5 U	63.0 U	750 U	3360	81.0 U	73	N/A (1)	[illegible]
SHR FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SSR 1 W1	WIPE	Total ug	34.3	9.80 U	27.2	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	61.5
SSR 1 W2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SP R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R3	RINSE	Total ug	[illegible]	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
WALL FLD BLK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	20.3	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed

(2) - Explosives Compounds not Analyzed

TEST RUN 15
600°F/12 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 15 - 600 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
AP1 S RINSE	RINSE	Total ug	159 U	116 J	32.5 J	73.8 U	52.5 U	625 U	240 U	50.0 U	[illegible]	N/A (1)	[illegible]
AP1 S RINSE'	RINSE	Total ug	15900 U	12300 U	26500 U	7380.0 U	5250 U	62500 U	[illegible]	5000 U	5250 U	N/A (1)	[illegible]
AP2 S RINSE	RINSE	Total ug	1590 U	240 J	2630 U	738.0 U	525 U	6250 U	2400 U	500 U	813	N/A (1)	813
AP2 S RINSE'	RINSE	Total ug	15900 U	12500 U	28000 U	7380.0 U	5250 U	62500 U	[illegible]	5000 U	5250 U	N/A (1)	[illegible]
CLAY PIPE	SOIL	ug/g	127000 U	[illegible]	[illegible]	[illegible]	42000 U	500000 U	657000	40000 U	42000 U	N/A (1)	[illegible]
CP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PC FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB1 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	0.435 J	200 U	210 U	N/A (1)	0
PB2 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHIP MINE	WIPE	Total ug	12.7 U	9.8 U	20.9 U	2.70 J	1.30 J	60.0 U	108	4.00 U	15.8	N/A (1)	[illegible]
SM FLD. BLNK	WIPE	Total ug	12.7 U	9.8 U	20.9 U	5.90 U	4.20 U	50.0 U	10.1 J	4.00 U	4.20 U	N/A (1)	0
SSR1 RINSE	RINSE	Total ug	19.1 U	118	28.3 J	8.93	6.30 U	75.0 U	28.8 U	6.00 U	6.30 U	N/A (1)	124
SSR1 RINSE'	RINSE	Total ug	19100 U	14700 U	31500 U	8850 U	6300 U	75000 U	323000	6000 U	6300 U	N/A (1)	[illegible]
SSR1 RINSE*	RINSE	Total ug	1910 U	1470 U	3150 U	885 U	630 U	7500 U	2880 U	600 U	450	N/A (1)	[illegible]
SSR1 W1/W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	8.40 J	4.00 U	4.20 U	N/A (1)	0
SSR1 W5/W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	16.5 J	4.00 U	4.20 U	N/A (1)	0
SSR2 RINSE	RINSE	Total ug	19100 U	14700 U	31500 U	8850 U	6300 U	75000 U	270000	6000 U	6300 U	N/A (1)	[illegible]
SSR2 RINSE'	RINSE	Total ug	191 U	1470 U	3150 U	885 U	630 U	7500 U	2880 U	600 U	885	N/A (1)	[illegible]
SSR2 RINSE*	RINSE	Total ug	19.1 U	103	28.4 J	9.90	6.30 U	75.0 U	28.8 U	6.00 U	6.30 U	N/A (1)	113
SSR2 W1/W4	WIPE	Total ug	28.8	41.0	20.9 U	5.90 U	4.20 U	50.0 U	10.1 J	4.00 U	24.9	N/A (1)	92.4
SSR2 W5/W8	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	93.8	4.00 U	3.30 J	N/A (1)	93.2
SSR2 W5/W8'	WIPE	Total ug	538	2446	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	[illegible]
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	6.60	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 15 - 600 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HMX	HDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
SSR 1 W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	4.80 J	4.00 U	1.30 J	N/A (1)	0
SSR 1 W2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	2.50 J	1.20 J	4.20 U	N/A (1)	0
SSR 1 W3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	1.40 J	4.00 U	4.20 U	N/A (1)	0
SSR 1 W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	1.80 J	4.00 U	4.20 U	N/A (1)	0
SSR 1 W5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	8.60 J	4.00 U	1.30 J	N/A (1)	0
SSR 1 W6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	2.60 J	4.00 U	1.40 J	N/A (1)	0
SSR 1 W7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	2.90 J	4.00 U	1.40 J	N/A (1)	0
SSR 1 W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	2.30 J	4.00 U	1.40 J	N/A (1)	0
SSR FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	2.30 J	4.00 U	4.20 U	N/A (1)	0
WALL FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	5.00 J	4.00 U	1.50 J	N/A (1)	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	7.60	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 16 - 600 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
AP 1 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
AP 1 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
AP 1 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
AP 1 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
AP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
CHMB WALL W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	1.80 J	4.00 U	1.90 J	N/A (1)	0
CLAY PIPE	SOIL	ug/g	1.27 U	0.980 U	2.09 U	0.590 U	0.420 U	5.00 U	1.02 U	0.400 U	0.420 U	N/A (1)	0
CP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1 R1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHP MAKE W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	1.50 J	4.00 U	1.70 J	N/A (1)	0
SHR 1 R1	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SHR FLD BLNK	RINSE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	288 U	60.0 U	63.0 U	N/A (1)	0
SM FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	1.20 J	4.00 U	1.40 J	N/A (1)	0

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

TEST RUN 16
600°F/6 HOURS

1311R2

HWAAP - Hot Gas Pilot Study
Pre Test 18 - 600 Deg F, 5 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CLAY PIPE	SOIL	ug/g	12700 U	6000 U	20000 U	5600 U	4200 U	50000 U	165000	4000 U	4200 U	N/A (1)	165000
CP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 2 R1/R4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHIP MINE W1	WIPE	Total ug	12.7 U	3.20 J	8.20 J	4.60 J	4.20 U	50.0 U	55.2	4.00 U	30.6	N/A (1)	63.8
SM FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	1.30 J	4.00 U	1.50 J	N/A (1)	0
SSR 1 SPK	RINSE	Total ug	1910 U	1470 U	3150 J	685 U	630 U	7500 U	2630 U	600 U	465 J	N/A (1)	0
SSR 1 SPK	RINSE	Total ug	19100 U	14700 U	31500 U	6850 U	6300 U	75000 U	165000	6000 U	6300 U	N/A (1)	165000
SSR 1 W1/W4	WIPE	Total ug	12.7 U	9.80 U	6.10 J	5.90 U	4.20 U	50.0 U	4.70 J	4.00 U	4.20	N/A (1)	4.20
SSR 1 W5/W8	WIPE	Total ug	33.4	240	17.6 J	3.10 J	19.4	50.0 U	846	4.00 U	8.00	N/A (1)	[illegible]
SSR 2 SPK	RINSE	Total ug	1910 U	1470 U	3150 U	685 U	630 U	7500 U	2680 U	600 U	600 J	N/A (1)	0
SSR 2 SPK	RINSE	Total ug	19100 U	14700 U	31500 U	6850 U	6300 U	75000 U	165000	6000 U	6300 U	N/A (1)	165000
SSR 2 W1/W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	0.600 J	4.00 U	3.80 J	N/A (1)	0
SSR 2 W5/W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.30	50.0 U	92.7	4.00 U	2.70 J	N/A (1)	67.0
SSR 2 W5/W8	WIPE	Total ug	378	1610	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	[illegible]
SSR FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	1.20 J	4.00 U	1.80 J	N/A (1)	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 18 - 600 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CLAY PIPE	SOIL	ug/g	1.27 U	0.500 U	2.00 U	0.500 U	0.42 U	5.00 U	1.92 U	0.400 U	0.420 U	N/A (1)	0
CP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
FC FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	10.8 J	4.00 U	1.10 J	N/A (1)	0
FL. CHMB WALL	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	14.8 J	4.00 U	2.30 J	N/A (1)	0
PB 1 DUP	RINSE	Total ug	254 U	198 U	418 U	118 U	84.0 U	1000 U	384 U	80.0 U	84.0 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB1 R 1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB1 R 2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB1 R 3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB1 R 4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHIP MINE W 1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	7.60 J	4.00 U	2.30 J	N/A (1)	0
SHR 1 DUP	RINSE	Total ug	254 U	198 U	418 U	118 U	84.0 U	1000 U	384 U	80.0 U	84.0 U	N/A (1)	0
SHR FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHR1 R 1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHR1 R 2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHR1 R 3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHR1 R 4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 16 - 600 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
SHV 1 DUP	RINSE	Total ug	254 U	[illegible] U	418 U	118 U	84.0 U	1000 U	364 U	80.0 U	84.0 U	N/A (1)	0
SHV FLD. BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHV R 1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	[illegible] U	200 U	210 U	N/A (1)	0
SHV R 2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHV R 3	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHV R 4	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SM FLD. BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	10.5 J	4.00 U	1.20 J	N/A (1)	0
SSR FLD. BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	[illegible] J	4.00 U	1.60 J	N/A (1)	0
SSR W 1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	12.1 J	4.00 U	4.20 U	N/A (1)	0
SSR W 2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	8.70 J	4.00 U	4.20 J	N/A (1)	0
SSR W 3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	10.3 J	4.00 U	4.20 U	N/A (1)	0
SSR W 4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	8.60 J	4.00 U	1.00 J	N/A (1)	0
SSR W 5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	8.70 J	4.00 U	4.20 U	N/A (1)	0
SSR W 6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	13.2 J	4.00 U	[illegible] J	N/A (1)	0
SSR W 7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	[illegible] J	4.00 U	[illegible] J	N/A (1)	0
SSR W 8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	10.2 J	4.00 U	4.20 U	N/A (1)	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL BL	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

TEST RUN 17
600°F/48 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 17 - 600 Deg F, 48 Hrs

EQUIPMENT	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	Nitrated Esters	TOTAL Explosives
AP 1	RINSE	Total ug	5460	490 U	1050 U	295 U	210 U	2500 U	7250	200 U	210 U	N/A (1)	12700
AP 1	RINSE	Total ug	6350 U	34300	10500 U	2050 U	2100 U	25000 U	9600 U	2000 U	2100 U	N/A (1)	[illegible]
AP 2	RINSE	Total ug	6750	17300	1050 U	295 U	210 U	2500 U	648 J	200 U	210 U	N/A (1)	24100
AP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	110 J	200 U	210 U	N/A (1)	0
PB 2	RINSE	Total ug	635 U	100 J	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 3	RINSE	Total ug	635 U	110 J	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHR 1	RINSE	Total ug	762 U	0.14 J	1260 U	354 U	252 U	3000 U	1150 U	240 U	252 U	N/A (1)	0
SHR 2	RINSE	Total ug	330 J	3250	1260 U	354 U	252 U	3000 U	150 J	240 U	252 U	N/A (1)	[illegible]
SHR FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHV 1	RINSE	Total ug	100 J	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	2840 J	N/A (1)	0
SHV 2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	1770	N/A (1)	1770
SHV FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SP 1	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP 2	RINSE	Total ug	635 U	490 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed

HWAAP - Hot Gas Pilot Study

Post Test 17 - 600 Deg F, 48 Hrs

EQUIPMENT	MATRIX	UNITS	AMMONIUM PICRATE
AP 1 R1	RINSE	Total ug	10000 U
AP 1 R2	RINSE	Total ug	10000 U
AP 1 R3	RINSE	Total ug	10000 U
AP 1 R4	RINSE	Total ug	10000 U
AP FLD BLNK	RINSE	Total ug	10000 U
CHMB WALL BLK	WIPE	Total ug	10.0 U
CHMB WALL W1	WIPE	Total ug	10.0 U
PB 1 R1	RINSE	Total ug	10000 U
PB 1 R2	RINSE	Total ug	10000 U
PB 1 R3	RINSE	Total ug	10000 U
PB 1 R4	RINSE	Total ug	10000 U
PB FLD BLNK	RINSE	Total ug	10000 U
SHR 1 R1	RINSE	Total ug	10000 U
SHR 1 R2	RINSE	Total ug	10000 U
SHR 1 R3	RINSE	Total ug	10000 U
SHR 1 R4	RINSE	Total ug	10000 U
SHR FLD BLK	RINSE	Total ug	10000 U
SHV 1 R1	RINSE	Total ug	10000 U
SHV 1 R2	RINSE	Total ug	10000 U
SHV 1 R3	RINSE	Total ug	10000 U
SHV 1 R4	RINSE	Total ug	10000 U
SHV FLD BLK	RINSE	Total ug	10000 U
SP FLD BLNK	RINSE	Total ug	10000 U
SP R1	RINSE	Total ug	10000 U
SP R2	RINSE	Total ug	10000 U
SP R3	RINSE	Total ug	10000 U
SP R4	RINSE	Total ug	10000 U

TEST RUN 13
500°F/6 HOURS

HWAAP - Hot Gas Pilot Study
Pre Test 18 - 500 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL EXPLOSIVES
CLAY PIPE	SOIL	ug/g	12700 U	[illegible] U	20000 U	5600 U	4200 U	50000 U	[illegible] U	4000 U	4200 U	N/A (1)	0
CLAY PIPE	SOIL	ug/g	127 U	58.0 U	209 U	58.0 U	42.0 U	500 U	[illegible]	40.0 U	42.0 U	N/A (1)	[illegible]
CP FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	[illegible] U	50.0 U	52.5 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	159 U	123 U	263 U	73.8 U	52.5 U	625 U	[illegible] U	50.0 U	52.5 U	N/A (1)	0
PB 1	RINSE	Total ug	635 U	180 J	1050 U	295 U	210 U	2500 U	[illegible] U	200 U	210 U	N/A (1)	0
PB 2	RINSE	Total ug	635 U	450 U	1050 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SHP MINE	WIPE	Total ug	12.7 U	9.60 U	30.5	5.00 U	21.1 U	50.0 U	19.2 U	4.00 U	39.1	N/A (1)	69.6
SHP MINE	WIPE	Total ug	4430	80.0 U	209 U	58.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	4430
SHP MINE	WIPE	Total ug	12700 U	[illegible]	20900 U	5600 U	4200 U	50000 U	4820	4000 U	4200 U	N/A (1)	37100
SM FLD BLNK	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.00 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR FLD BLNK	WIPE	Total ug	12.7 U	2.60 J	20.9 U	5.00 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR1 SPIKE R	RINSE	Total ug	63.5 U	49.0 U	105 U	29.5 U	21.0 U	250 U	1580	20.0 U	7.00	N/A (1)	1310
SSR1 W1-W4	WIPE	Total ug	2.10 J	14.2	20.9 U	5.00 U	8.70	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	23.9
SSR1 W5-W8	WIPE	Total ug	481	9.60 U	20.9 U	5.00 U	1.60 J	50.0 U	216	4.00 U	4.20 U	N/A (1)	697
SSR1 W5-W8	WIPE	Total ug	127 U	1030	209 U	50.0 U	42.0 U	500 U	192 U	40.0 U	42.0 U	N/A (1)	1650
SSR2 SPIKE R	RINSE	Total ug	63.5 U	49.0 U	105 U	20.5 U	21.0 U	250 U	3790	20.0 U	8.00	N/A (1)	[illegible]
SSR2 W1-W4	WIPE	Total ug	12.7 U	3.50 J	20.9 U	5.00 U	65.7	50.0 U	1.30 J	4.00 U	4.20 U	N/A (1)	65.7
SSR2 W5-W8	WIPE	Total ug	12.7 U	9.60 U	20.9 U	5.00 U	4.20 U	50.0 U	30.5 J	4.00 U	4.20 U	N/A (1)	0
SHP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	27.5	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 18 - 600 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL [illegible]
CHMB WALL BL	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CHMB WALL W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
CLAY PIPE	SOIL	ug/g	1.27 U	0.980 U	2.09 U	0.590 U	0.420 U	5.00 U	1.92 U	0.400 U	0.420 U	N/A (1)	0
CLAY PIPE BL	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	697	480 U	100 U	105 U	N/A (1)	697
PB 1 R1	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB 1 R2	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB 1 R3	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB 1 R4	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB FLD BLNK	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHP MNE W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHR 1 R1	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHR 1 R2	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHR 1 R3	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	450 U	100 U	105 U	N/A (1)	0
SHR 1 R4	RINSE	Total ug	313 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHR FLD BLNK	RINSE	Total ug	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SM FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	39.6	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	39.6

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Fuel Test 18 - 600 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	TETRYL	2,4,6-TNT	2,6-DNT	2,4-DNT	NITRATED ESTERS	TOTAL [illegible]
SSR 1 W1	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W2	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W3	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W4	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W5	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W6	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W7	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1 W8	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR FLD BLNK	WIPE	Total ug	12.7 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SHIP MINE W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SM FLD BLNK	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL W2	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL BL	WIPE	Total ug	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
MOTOR SOAK	RINSE	Total ug	220 U	170 U	370 U	100 U	74 U	660 U	340 U	70 U	70 U	N/A (1)	0

(1) - Nitrated Esters not Analyzed.

(2) - Explosive Compounds not Analyzed.

APPENDIX I

EXAMPLE CALCULATIONS

Appendix I contains the following calculations:

- Calculations to determine time for slab to reach temperature.
- Heat balance calculations for Test Runs T2, T3, and T5.

July 1990
Revision: Final

CALCULATIONS TO DETERMINE TIME FOR SLAB TO REACH TEMPERATURE

1311R2

WESTON

SHEET 1 of 6

CLIENT/SUBJECT ____ W.O. NO. ____

TASK DESCRIPTION Time For Slab To Reach Temperature TASK NO. ____

PREPARED BY NPS DEPT 1811 DATE ____

MATH CHECK BY ____ DEPT ____ DATE ____

METHOD REV. BY ____ DEPT ____ DATE ____

APPROVED BY ____ DEPT ____ DATE ____

The following calculations have been prepared to determine the time required for items to reach target temperature.

Assumptions:

1) Rectangular slab will be evaluated
2) Length = 1 FT
3) Height = 1 FT
4) Material of Construction - Steel

Calculations will be prepared for 4 separate cases:

- 500 lb slab
- 1000 lb slab
- 1500 lb slab
- Slab that is as large as permissable in chamber (6 FT H x 20 FT L x 6 FT ...

Unsteady-state conditions exist. Slab will be placed at front of chamber (near door) in vicinity of air discharge duct (i.e, worst case - lowest air temperatures).

The heat transfer coefficient for the system was calculated to be 1.44 BTU/hr FT² °F (see worksheet - insulation calculations for flash chamber).

Data:

k_{steel} = 25.9 BTU/hr FT² (°F/FT) @ 212°F (Bennett ; Myers, 2nd Ed, Page 773)

Cp_{steel} = 0.12 BTU/lb °F (Bennett ; Myers, 2nd Ed, Page 773)

ρ_{steel} = 489 lb/FT³ (Bennett ; Myers, 2nd Ed, Page 773)

CLIENT/SUBJECT ______ W.O. NO ______
TASK DESCRIPTION Time for Slab to Reach Temperature TASK NO ______
PREPARED BY NPS DEPT 1511 DATE ______ APPROVED BY
MATH CHECK BY ______ DEPT ______ DATE ______
METHOD REV. BY ______ DEPT ______ DATE ______ DEPT ______ DATE ______

To estimate time, the "chart for determining the temperature history of points at the centers of rectangular shapes" was utilized (Process Heat Transfer, Kern, p. 655). A copy of the chart is shown on Figure 18-11.

In chart, $Y = \frac{T_s - t_{1/2}}{T_s - t_o}$

where T_s = temperature of surrounding (air)
$t_{1/2}$ = temperature of the center plane
t_o = initial temperature

in this application:

T_s = 550°F (during heat-up)
$t_{1/2}$ = 500°F
t_o = 70°F

In chart, $X = \frac{hL}{2k}$

where h = heat transfer coefficient
L = principal dimension
k = thermal conductivity

For illustration, 4 masses of steel are evaluated.

$L = \frac{m}{\rho \, Ht \, l}$

where Ht = height of slab (1 ft in cases 1, 2, 3; 6 ft in case 4)
l = length of slab (1 ft in cases 1, 2, 3; 6 ft in case 4)

WESTON

SHEET 3 of 6

CLIENT/SUBJECT ______ W.O. NO. ______

TASK DESCRIPTION Time for Slab to Reach Temperature TASK NO. ______

PREPARED BY NPS DEPT 1911 DATE ______ APPROVED BY

MATH CHECK BY ______ DEPT ______ DATE ______

METHOD REV. BY ______ DEPT ______ DATE ______ DEPT ______ DATE ______

Therefore,

$$X = \frac{h\,L}{2k}$$

$$= \frac{h\,m}{2k\,\rho\,ht\,l}$$

On chart, curve $= \dfrac{4\alpha\theta}{L^2}$

where: $\alpha = \dfrac{k}{C_p}$

C_p = Specific heat

θ = time

Therefore, curve $= \dfrac{4k\theta}{C_p\left(\dfrac{m}{\rho\,ht\,l}\right)^2}$

Case 1 $m = 500$ lb

$$Y = \frac{T_s - t_{1/2}}{T_s - t_o} = \frac{550°F - 500°F}{550°F - 70°F} = 0.10$$

$$X = \frac{h\,m}{2k\,\rho\,ht\,l}$$

$$X = \frac{1.44\ BTU}{hr\ Ft^2\ °F}\left|\frac{500\ lb}{}\right|\frac{}{2}\left|\frac{hr\ Ft^2\ °F}{25.9\ BTU\ Ft}\right|\frac{Ft^3}{489\ lb}\left|\frac{}{1\ Ft}\right|\frac{}{1\ Ft}$$

$X = 0.028$

WESTON

CLIENT/SUBJECT ______ W.O. NO. ______
TASK DESCRIPTION Time for Slab to Reach Temperature TASK NO. ______
PREPARED BY NPI DEPT 1811 DATE ______ APPROVED BY
MATH CHECK BY ______ DEPT ______ DATE ______
METHOD REV. BY ______ DEPT ______ DATE ______ DEPT ______ DATE ______

At $X = 0.028$ and $Y = 0.10$ there is no curve.

Extrapolating (For $X = 0.028$)

$$\text{Curve} = \frac{0.046 - 0.054}{50 - 45} = \frac{0.046 - 0.028}{50 - \text{curve}}$$

$$\text{Curve} = 61$$

$$61 = \frac{4 k \theta}{C_P \left(\frac{m}{\rho h_t W}\right)^2} = 4 \left| \frac{25.9 \text{ BTU F.}}{\text{hr Ft}^2 \text{ °F}} \right| \theta \left| \frac{16 \text{ °F}}{0.12 \text{ BTU}} \right| \frac{\left[(489 \text{ lb/Ft}^3)(1 \text{ Ft})(1\right.}{(500 \text{ lb})^2}$$

$$\theta = 0.074 \text{ hr} \quad (4.4 \text{ min})$$

Case 2 $m = 1000$ lb

$Y = 0.10$

$$X = \frac{h\,m}{2 k \rho h_t W} = \frac{1.44 \text{ BTU}}{\text{hr Ft}^2 \text{ °F}} \left| 1000 \text{ lb} \right| \frac{1}{2} \left| \frac{\text{hr Ft}^2 \text{ °F}}{25.9 \text{ BTU Ft}} \right| \frac{\text{Ft}^3}{489 \text{ lb}} \left| \frac{1}{1 \text{ Ft}} \right| \frac{1}{1 \text{ Ft}}$$

$X = 0.057$

At $X = 0.057$ and $Y = 0.10$

$$\text{Curve} = 42$$

WESTON

CLIENT/SUBJECT ______ W.O. NO. ______
TASK DESCRIPTION Time for Slab to Reach Temperature TASK NO. ______
PREPARED BY NPS DEPT 1811 DATE ______ APPROVED BY ______
MATH CHECK BY ______ DEPT ______ DATE ______
METHOD REV. BY ______ DEPT ______ DATE ______ DEPT ______ DATE ______

$$42 = \frac{4k\theta}{C_P\left(\frac{m}{\rho h_t l}\right)^2} = \frac{4 \mid 25.9\ \text{BTU Ft} \mid \theta \mid 16\ °F}{\mid hr\ Ft^2\ °F \mid \mid 0.12\ \text{BTU}} \left| \frac{[(489\ lb/Ft^3)(1\ Ft)(1\ Ft)]^2}{(1000\ lb)^2} \right.$$

$\theta = 0.20$ hr (12 minutes)

Case 3 m = 1500 lb

$Y = 0.10$

$$X = \frac{hm}{2k\rho h_t l} = \frac{1.44\ \text{BTU}}{hr\ Ft^2\ °F} \left| \frac{1500\ lb}{} \right| \frac{}{2} \left| \frac{hr\ Ft^2\ °F}{25.9\ \text{BTU Ft}} \right| \frac{Ft^3}{489\ lb} \left| \frac{}{1\ Ft} \right| \frac{}{1\ Ft}$$

$X = 0.085$

At $Y = 0.10$ and $X = 0.085$, curve ≈ 40

$$40 = \frac{4k\theta}{C_P\left(\frac{m}{\rho h_t l}\right)^2} = \frac{4 \mid 25.9\ \text{BTU Ft} \mid \theta \mid 16\ °F}{\mid hr\ Ft^2\ °F \mid \mid 0.12\ \text{BTU}} \left| \frac{[(489\ lb/Ft^3)(1\ Ft)(1\ Ft)]^2}{(1500\ lb)^2} \right.$$

$\theta = 0.43$ hr (26 min)

Case 4 SLAB = 6 Ft H x 20 Ft L x 6 FT D

$$m = (6\ Ft \times 20\ Ft \times 6\ Ft) \left| \frac{489\ lb}{Ft^3} \right. = 352{,}080\ lb$$

$Y = 0.10$

$$X = \frac{hm}{2k\rho h_t l} = \frac{1.44\ \text{BTU}}{hr\ Ft^2\ °F} \left| \frac{352\,080\ lb}{} \right| \frac{}{2} \left| \frac{hr\ Ft^2\ °F}{25.9\ \text{BTU Ft}} \right| \frac{Ft^3}{489\ lb} \left| \frac{}{6\ Ft} \right| \frac{}{20\ FT}$$

$X = 0.17$

At $Y = 0.10$ and $X = 0.17$, Curve = $20 = \frac{4 \mid 25.9\ \text{BTU Ft} \mid \theta \mid 16\ °F}{\mid hr\ Ft^2\ °F \mid \mid 0.12\ \text{BTU}}\ (6\ Ft)^2$

$\theta = 0.83$ hr (50 min)

Time For Slab to Reach Temperature
NPJ 1811

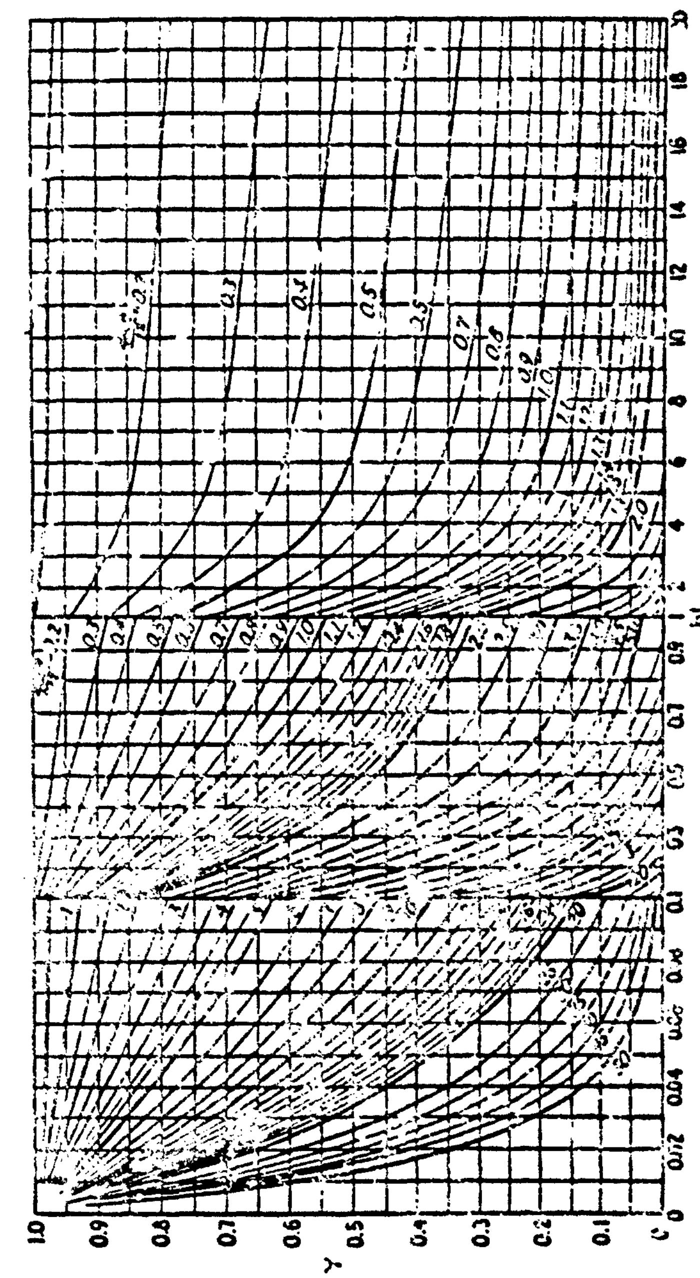


FIG. 10.11. Chart for determining the temperature history of points at the centers of rectangular shapes. (Newman, Industrial Engineering Chemistry.)

July 1969
Revision: Final

HEAT BALANCE CALCULATIONS

TEST RUNS

2, 3, & 5

1311R2

WESTON

SHEET 1 of 20

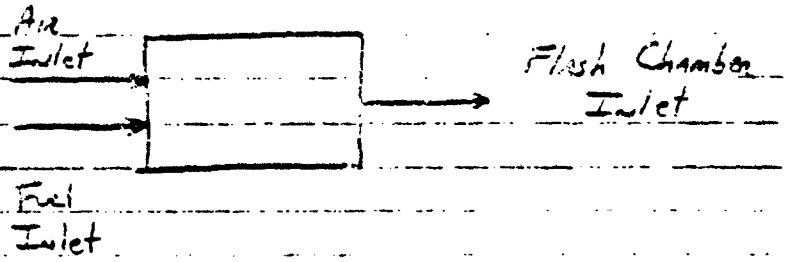
CLIENT/SUBJECT USATHAMA · W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT 1311 DATE 14 Feb 90 APPROVED BY

MATH CHECK BY ______ DEPT ______ DATE ______

METHOD REV. BY ______ DEPT ______ DATE ______ DEPT ______ DATE ______



Average Inlet Air Flow PI-202 1.05 in wg ± .18
Test Elapsed Time 1400 - 4400

Average Fuel Gas Pressure PI 310 1.70 psig ± .14
Test Elapsed Time 1400 - 4400

Average Flash Chamber Inlet measured data

1566 dscfm ± 74%
312 °F (733 °F on process thermocouple)
4400 wacfm
1.8% CO_2 by volume dry basis
17.2% O_2
80.7% N_2
3.2% H_2O by volume

CO_2 (1566 dscfm)(.018 CO_2)(.11378 lb/scf) = 3.21 lb/min

O_2 (1566 dscfm)(.172 O_2)(.08275 lb/scf) = 22.28 lb/min

N_2 (1566 dscfm)(.807 N_2)(.07240 lb/scf) = 91.50 lb/min

H_2O $\frac{X}{1566 + X}$ = .032

X = (51.77 cfm)(.04654 lb/scf) = 2.41 lb/min

119.40 lb/min

RFW 10-08-003/A-5/85

WESTON

SHEET 2 of 13

CLIENT SUBJECT USATHAMA W.O. NO. 2600-00-24

TASK DESCRIPTION Test Run # 2 Heat Balance TASK NO. 2

PREPARED BY M. Collins DEPT 1811 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY ______ DEPT ______ DATE ______

METHOD REV. BY ______ DEPT ______ DATE ______ DEPT ______ DATE ______

Correction to gas flow for altitude

CORR = e (.0000360256 (4500 ft)) = 1.176

Design location = e (.0000360256 (1750 ft)) = 1.066

Density ratios = 1.176 / 1066 = 1.103

Pgraph = (ρact / ρgraph) (Pact)

= 1.103 (1.70 psig)

= 1.875 psig

From Vendor Graph 802 1.875 psig = 1.75 mm BTU/hr LHV

(1,750,000 BTU/hr) / (2316 BTU/scf) = 755

756 scf/hr = 12.6 scfm propane

(12.59 scfm)(0.1196 lb/scf) = 1.51 lb/min

Combustion Air Flow by

Flow = 1433 + 466 (ln (1.05 in wg)) = 1453 scfm

(1450 scfm)(.075 lb/scf) = 105 lb/min

Moisture load under worst conditions

60°F = 0.01 lb H2O/lb Air

WESTON

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CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT 1811 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Maximum water Load

$(105\ lb/min)(.01\ lb\ H_2O/lb\ air) = 1.05\ lb/min$

Mass Balance Check

$$\frac{119.40\ lb/min - [1.51\ lb/min + 105\ lb/min + 1.05\ lb/min]}{117.4\ lb/min}$$

$= 9.92\ \%$ closure within measurement errors

Combustion of Propane 1 lb basis

CO_2 2.99 lb/lb
H_2O 1.63 lb/lb
N_2 12.07 lb/lb

Total 16.69 lb/lb − 1 lb/lb = 15.69 lb/lb comb air

Combustion of Fuel

CO_2 $(1.51\ lb/min)(2.99\ lb/lb) = 4.51\ lb/min$
H_2O $(1.51\ lb/min)(1.63\ lb/lb) + (1.05\ lb/min) = 3.51\ lb/min$
N_2 $(1.51\ lb/min)(12.07\ lb/lb) = 18.23\ lb/min$

Excess Air = inlet air − combustion air

$(105\ lb/min) - (1.51\ lb/min)(15.69\ lb/lb) = 81.31\ lb/min$

$O_2 = (81.31\ lb/min)(0.21\ \%\ O_2) = 17.07\ lb/min$

CLIENT/SUBJECT [illegible] W.O. NO. 2000-00-27
TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. 2
PREPARED BY M. Cosimos DEPT 1911 DATE 16 Feb 90 APPROVED BY
MATH CHECK BY DEPT DATE
METHOD REV. BY DEPT DATE DEPT DATE

Heat Balance

Heat Released by Fuel

$(1.51 \text{ lb/min})(19{,}944 \text{ BTU/lb}) = 30{,}115 \text{ BTU/min}$

Heat Absorbed by Combustion Products

CO_2 $(4.51 \text{ lb/min})(0.225 \text{ BTU/lb°F})(812-70\text{°F}) = 753 \text{ BTU/min}$

H_2O $(3.51 \text{ lb/min})(0.478 \text{ BTU/lb°F})(812-70\text{°F}) = 1{,}244 \text{ BTU/min}$

N_2 $(18.23 \text{ lb/min})(0.25 \text{ BTU/lb°F})(812-70\text{°F}) = 3{,}382 \text{ BTU/min}$

Heat Absorbed by xs Air

$(81.31 \text{ lb/min})(0.24 \text{ BTU/lb°F})(812-70\text{°F}) = \underline{14{,}480 \text{ BTU/min}}$

$19{,}859 \text{ BTU/min}$

Radiation Losses

Surface Area

$\pi(20 \text{ inch})(\text{ft}/12\text{ inch})(6.5 \text{ ft} + 24.5 \text{ ft}) = 162. \text{ ft}^2$

$(162 \text{ ft}^2)(2.8 \text{ BTU/hr ft}^2\text{°F})(200\text{°F}-70\text{°F})(\text{hr}/60\text{ min}) = 1742 \text{ BTU/min}$

Heat Balance Comparison

$$\frac{(30{,}115 \text{ BTU/min}) - (19{,}859 \text{ BTU/min} + 1742 \text{ BTU/min})}{30{,}115 \text{ BTU/min}} = 28.3\%$$

WESTON

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run # 2 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT 1811 DATE 16 Feb 89 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Average Flash Chamber Outlet

2067 dscfm ± 5%
391 °F ± 37 °F
3917 wacfm
1.13 % CO_2
15.97 % O_2
81.25 % N_2
2.87 % H_2O

CO_2 (2067 dscfm)(0.0113)(0.11378 lb/scf) = 2.66 lb/min

O_2 (2067 dscfm)(0.1597)(0.0827 lb/scf) = 27.30 lb/min

N_2 (2067 dscfm)(0.8125)(0.07240 lb/scf) = 121.59 lb/min

H_2O $\frac{x}{2067 + x} = .0287$

x = (61.08 cfm)(.04654 lb/scf) = 2.84 lb/min

Total Exit Gas Flow 154.39 lb/min

Leakage Estimate

$\frac{154.39 \text{ lb/min} - 119.40 \text{ lb/min}}{154.39 \text{ lb/min}} = 22.67\%$

Leakage Volume

(154.39 lb/min - 119.40 lb/min) = 34.99 lb/min

RFW 10-05-003/A-5/86

WESTON

SHEET 6 of 13

CLIENT/SUBJECT USATHAMA W.O. NO. 2600-00-24
TASK DESCRIPTION Test Run # 2 Heat Balance TASK NO. 2
PREPARED BY M. Cosmos DEPT 1811 DATE 16 Feb 90 APPROVED BY
MATH CHECK BY ____ DEPT ____ DATE ____
METHOD REV. BY ____ DEPT ____ DATE ____ DEPT ____ DATE ____

Heat Balance Around Test Chamber

Heat Lost by Process Gas

CO_2 $\left(\frac{3.21+2.66}{2}\right)(0.225\ BTU/lb \cdot F)(812-391°F) = 278\ BTU/min$

H_2O $\left(\frac{2.41+2.84}{2}\right)(0.478\ BTU/lb°F)(812-391°F) = 528\ \frac{BTU}{min}$

N_2 $\left(\frac{91.50+(121.59-.79(34.99))}{2}\right)(0.25)(812-391°F) = 9,759\ \frac{BTU}{min}$

O_2 $\left(\frac{22.28+(27.30-.21(34.99))}{2}\right)(0.24)(812-391°F) = 2,134\ \frac{BTU}{min}$

Total Heat Lost by Hot Gas $12,599\ \frac{BTU}{min}$

Heat Absorbed by Leak Air

$(34.99\ lb/min)(0.24\ BTU/lb°F)(391-70°F) = 2,696\ BTU/min$

Heat Lost Through Walls

$(12,599\ BTU/min) - (2696\ BTU/min) = 9,903\ BTU/min$
$= 594,202\ BTU/hr$

CLIENT/SUBJECT USATHAMA W.O. NO 7000-00-24
TASK DESCRIPTION Test Run #2 Heat Balance TASK NO.
PREPARED BY M. Cosmos DEPT 1311 DATE
MATH CHECK BY DEPT DATE
METHOD REV. BY DEPT DATE
APPROVED BY
DEPT DATE

Average Fuel Gas Pressure 6.34 psig

Average T.O. Exit Gas

2467 dscfm ± 5.5%
1718 °F
12,500 wacfm
6.5 % CO_2
10.7 % O_2
82.8 % N_2
8.6 % H_2O

CO_2 (2467 dscfm)(.065 CO_2)(.11378 lb/dscf) = 18.2 lb/min

O_2 (2467 dscfm)(.107 O_2)(.08275 lb/dscf) = 21.8 lb/min

N_2 (2467 dscfm)(.828 N_2)(.07240 lb/dcf) = 147.9 lb/min

H_2O $\frac{x}{2467 + x}$ = .086

x = (232 cfm)(.0465 lb/cf) = 10.80 lb/min

198.7 lb/min

Gas Flow

P_{graph} = (1.103)(6.34 psig)

= 6.99 psig = 4.5 MM BTU/hr

WESTON

SHEET 3 of 10

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run #2 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

(4,570,000 BTU/hr) / 2316 BTU/scf = 1943 scfh
= 32.4 scfm

(32.4 scfm)(0.1196 lb/sF) = 3.87 lb/min

Air Leakage

198.7 lb/min − (154.4 lb/min + 3.87 lb/min) = 40.4 lb/min
20.3%

Combustion Product

CO_2 (3.87 lb/min)(2.99 lb/lb) = 11.57 lb/min

H_2O (3.87 lb/min)(1.63 lb/lb) = 6.31 lb/min

N_2 (3.87 lb/min)(12.07 lb/lb) = 46.71 lb/min

Air Consumed (3.87 lb/min)(15.69 lb/lb) = 60.72 lb/min

Mass Balance Check

CO_2 $\frac{18.2 \text{ lb/min} - (11.57 \text{ lb/min} + 2.94 \text{ lb/min})}{18.2 \text{ lb/min}}$ = 20.3%

H_2O $\frac{10.80 \text{ lb/min} - (6.31 \text{ lb/min} + 2.62 \text{ lb/min})}{10.8 \text{ lb/min}}$ = 17.3%

N_2 $\frac{147.9 \text{ lb/min} - (421.59 + .79(40.4 \text{ lb/min}))}{147.9 \text{ lb/min}}$ = −3.8%

RFW 10-05-003/A-5/85

WESTON

SHEET 9 of 10

CLIENT/SUBJECT USATHAMA | W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run #2 Heat Balance | TASK NO.

PREPARED BY M. Cosmos | DEPT 1311 | DATE 24 Feb 90 | APPROVED BY

MATH CHECK BY | DEPT | DATE

METHOD REV. BY | DEPT | DATE | DEPT | DATE

$$O_2 \quad \frac{(21.8\ lb/min) - (27.30\ lb/min + .21(40.4\ lb/min) - .21(60.72))}{21.8\ lb/min}$$

$$= -5.66\%$$

Heat Balance Check

Heat Released by Fuel

$(3.87\ lb/min)(19{,}944\ BTU/lb) = 77{,}183\ BTU/min$

Heat Absorbed by F.C. Exit Gases

$CO_2 \quad (2.94\ lb/min)(.0225\ BTU/lb°F)(1718-391\ °F) = 87.8\ BTU/min$

$H_2O \quad (2.62\ lb/min)(.478\ BTU/lb°F)(1718-391\ °F) = 1662\ BTU/min$

$N_2 \quad (121.59\ lb/min)(.25\ BTU/lb°F)(1718-391\ °F) = 40337\ BTU/min$

$O_2 \quad (27.30 - .21(60.72))(.22\ BTU/lb°F)(1718-391°F) = 4{,}247\ BTU/min$

$46{,}334\ BTU/min$

Heat Absorbed by Combustion Products

$CO_2 \quad (11.57\ lb/min)(0.225\ BTU/lb°F)(1718-391°F) = 3455\ BTU/min$

$H_2O \quad (6.31\ lb/min)(0.478\ BTU/lb°F)(1718-391°F) = 4002\ BTU/min$

$7457\ BTU/min$

Heat Absorbed by Leak Air

$Air \quad (70.4\ lb/min)(0.24\ BTU/lb°F)(1787-70°F) = 16{,}648\ BTU/min$

WESTON

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run #2 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE 24 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Radiation Losses

Surface Area

$\pi (5 ft)(20 ft) = 314 ft^2$

Heat Loss

$(314 ft^2)(2.8 \, BTU/hr \, ft^2 \, °F)(300-70 °F)(hr/60 min) = 3370 \, BTU/min$

Total Losses

$(46,334 \, BTU/min + 7457 \, BTU/min + 16,648 \, BTU/min + 3370 \, BTU/min) = 73,809 \, BTU/min$

Closure Balance

$$\frac{(77,183 \, BTU/min - 73,809 \, BTU/min)}{77,183 \, BTU/min} = 4.4\%$$

WESTON

SHEET 1 of 11

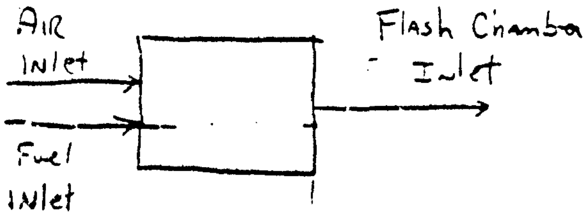
CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-34

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE 20 Sep 89 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE



Average Inlet Air flow PI202 1.11 in wg ±

Average Fuel Gas Pressure PI310 2.81 psig ±

Average Flash Chamber Inlet measured data

1633 dscfm ± 7%
1031 °F (959°F on process thermocouple
5533 wacfm
2.1 % CO_2 by Volume d. basis
16.3 % O_2 by Volume d. basis
81.5 % N_2 by Volume d. basis
3.2 % H_2O by Volume

CO_2 (1633 dscfm)(.021 CO_2)(.11378 lb/scf) = 3.90 lb/min

O_2 (1633 dscfm)(.163 O_2)(.08275 lb/scf) = 22.03 lb/min

N_2 (1633 dscfm)(.815 N_2)(.07240 lb/scf) = 96.36 lb/min

H_2O $\frac{x}{1633\ scfm + x} = .032$

x = (53.98 cfm)(.04654 lb/scf) = 2.51 lb/min

124.80 lb/min

RFW 10-05-003/A-5/85

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-21

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.

PREPARED BY M.Cosimos DEPT 1311 DATE 20Sep89 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Correction to gas flows for altitude

corr = $e^{(.0000360286(4500ft))}$ = 1.176

Design location = $e^{(.0000360286(1770ft))}$ = 1.066

Density ratios = 1.176 / 1.066 = 1.103

$P_{graph} = (\rho_{act}/\rho_{graph})(P_{act})$

= 1.103 (2.81 psig)

= 3.10 psig

From vendor graph 802 3.10 psig = 2.15 mm BTU/hr LHV

2,150,000 BTU/hr / (2316 BTU/SCF) =

928 scfh = 15.47 scfm propane

(15.47 scfm)(0.1196 lb/scf) = 1.85 lb/min

Combustion Airflow by correlation curve

Flow = 1433 +- 40.6 (ln(1.11 in wg)) = 1475 sc

(1450 scfm)(.075 lb/scf) = 108.7 lb/min

Moisture loading under worst observed conditions 60°F = .01 lb H_2O/lb dA

WESTON

SHEET 3 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION TASK NO.

PREPARED BY DEPT DATE APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Maximum water load

$(108.7 \text{ lb/min})(.01 \text{ lb}_{H_2O}/\text{lb dA}) = 1.1 \text{ lb/min } H_2O$

Mass Balance Check out-in/out =

$$\frac{124.80 \text{ lb/min} - (1.85_{\text{gas}} + 108.7_{\text{Air}} + 1.1_{H_2O})}{124.8 \text{ lb/min}} =$$

10.5% closure within measurement errors

Combustion of Propane one lb bases

CO_2	2.99 lb/lb
H_2O	1.63 lb/lb
N_2	12.07 lb/lb

Total 16.69 lb/lb - lb/lb - 15.69 lb/lb

Combustion of Fuel

$CO_2 = (1.85)(2.99 \text{ lb/lb}) = 5.53 \text{ lb/min}$

$H_2O = (1.85)(1.63 \text{ lb/lb}) = 3.02 + 1.1 = 4.12 \text{ lb/min}$

$N_2 = (1.85)(12.07 \text{ lb/lb}) = 22.33$

Excess Air

$(108.7 \text{ lb/min} - (1.85 \text{ lb/min})(15.69 \text{ lb/min})) = 79.67 \text{ lb/min}$

$O_2 = (79.67 \text{ lb/min})(.21) = 16.73 \text{ lb/min}$

RFW 10-05-003/A-5/85

SHEET 7 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2003-00-24

TASK DESCRIPTION Test Run #3 - Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 311 DATE 21 Sep 89 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Heat Balance

Heat Released by Fuel

$(1.85\ lb/min)(19,944\ BTU/lb) = 36,896\ BTU/min$

Heat Absorbed by Combustion Products

CO_2 $(5.53\ lb/min)(0.225\ BTU/lb\cdot°F)(1031-70°F) = 1,196\ BTU/min$

H_2O $(4.12\ lb/min)(0.478\ BTU/lb\cdot°F)(1031-70) = 1,893\ BTU/min$

N_2 $(22.33\ lb/min)(0.25\ BTU/lb\cdot°F)(1031-70) = 5,365\ BTU/min$

XS Air $(79.67\ lb/min)(0.24\ BTU/lb\cdot°F)(1031-70) = 18,375\ BTU/min$

$26,829\ BTU/min$

Radiation Losses

Surface Area

$\pi\ (20\ inch)\left(\frac{1\ ft}{12}\right)(6.5\ ft + 24.5\ ft) = 162\ ft^2$

$(162\ ft^2)(2.8\ BTU/hr\,°F\,ft^2)(300°F-70°F)\left(\frac{hr}{60\ min}\right) = 1,742\ BTU/min$

Heat Balance Comparison

$$\frac{(36,896\ BTU/min) - (26829 + 1742)}{36,896\ BTU/min} = 22.6\%\ \text{closure}$$

SHEET 5 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-21

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.

PREPARED BY M Cooper DEPT 1811 DATE 21 Sep 89 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Average Flash Chamber Outlet

1833 dscfm ± 3%
482 °F ± 37°F
3100 wacfm
1.26 % CO_2 by vol
17.43 % O_2 by vol
81.30 % N_2 by vol
3.83 % H_2O by vol

CO_2 (1833 dscfm)(0.0126 CO_2)(0.11378 lb/scf) = 2.63 lb/min

O_2 (1833 dscfm)(0.1743 O_2)(0.0827 lb/scf) = 26.42 lb/min

N_2 (1833 dscfm)(0.8130 N_2)(0.07270 lb/scf) = 107.89 lb/min

H_2O $\frac{x}{1833 + x} = .0383$

x = (73.00 cfm)(.04654 lb/scf) = 3.40 lb/min

Total exit mass flow 140.34 lb/m

Leakage Estimate

$\frac{140.34 \text{ lb/min} - 124.80 \text{ lb/min}}{140.34} = 11\%$

Leakage Volume

140.34 - 124.80 = 15.54 lb/min

WESTON

SHEET 6 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24
TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.
PREPARED BY M. Cimms DEPT 1811 DATE 2 Sep 89 APPROVED BY
MATH CHECK BY DEPT DATE
METHOD REV. BY DEPT DATE DEPT DATE

Heat Balance Around Test Chamber

Heat Lost by Process Gas

CO_2 $\left(\frac{2.40+2.63}{2} \text{ lb/min}\right)(0.225 \text{ BTU/lb°F})(1031-482\text{°F}) = 463 \text{ BTU/min}$

H_2O $\left(\frac{2.51+3.40}{2} \text{ lb/min}\right)(0.478 \text{ BTU/lb°F})(1031-482\text{°F}) = 775 \text{ BTU/min}$

N_2 $\left(\frac{95.36+(107.89-.79(15.54))}{2}\right)(.25 \text{ BTU/lb°F})(1031-482\text{°F}) = 13,174 \text{ BTU/m}$

O_2 $\left(\frac{22.03+(26.72-.21(15.54))}{2}\right)(.22 \text{ BTU/lb°F})(1031-482\text{°F}) = 2,729 \text{ BTU}$

Total Heat Lost 17,081 BTU/m

Heat Absorbed by Leak Air

$(15.54 \text{ lb/min})(0.24 \text{ BTU/lb°F})(482-70\text{°F}) = 1,537 \text{ BTU/m}$

Heat Lost Through Walls

$(17,081 \text{ BTU/min}) - (1537 \text{ BTU/min}) = 15,544 \text{ BTU/min}$

932,664 BTU/hr

WESTON

SHEET 2 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE 21 Sep 89 APPROVED BY

MATH CHECK BY DEPT. DATE

METHOD REV. BY DEPT. DATE DEPT DATE

Average Fuel Gas Pressure 6.58 psig

Average T.O. exit Gas

2000 dscfm ± 5%
1787 °F
10,700 wacfm
6.47 % CO_2 by vol
10.83 % O_2 by vol
82.70 % N_2 by vol
10.07 % H_2O by volume

CO_2 (2000 dscfm)(.0647 CO_2)(.1137 lb/scf) = 14.72 lb/min

O_2 (2000 dscfm)(0.1083 O_2)(.0828 lb/scf) = 17.92 lb/min

N_2 (2000 dscfm)(0.8270 N_2)(.07240 lb/scf) = 119.75 lb/min

H_2O $\frac{x}{2000 + x} = .1007$

x = (224 scfm)(.04651 lb/scf) = 10.42 lb/min

162.81 lb/min

Gas Flow

Pgraph = (1.103)(6.58 psig)

= 7.25 psig = 4.3 mm BTU/hr

RFW 10-05-003/A-5/85

WESTON

SHEET 3 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2008-00-24

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 134 DATE 21 Sep 89 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

(4,800,000 min Btu/hr)/(2316 Btu/scf) = 2073 scfh = 34.5 scfm

(34.5 scfm)(0.1196 lb/scf) = 4.13 lb/min

Air In Leakage

$\frac{162.8 \text{ lb/min} - (140.3 \text{ lb/min} + 4.13 \text{ lb/min})}{} = 18.37 \text{ lb/min} = 11.3\%$

Combustion Products from propane

CO_2 (4.13 lb/min)(2.99 lb/lb) = 12.35 lb/min

H_2O (4.13 lb/min)(1.63 lb/lb) = 6.73 lb/min

N_2 (4.13 lb/min)(12.07 lb/lb) = 49.85 lb/min

Air Consumed (4.13 lb/min)(15.69 lb/min) = 64.80 lb/min Air

Mass Balance Check

CO_2 $\frac{14.72 \text{ lb/min} - (12.35 \text{ lb/min} + 2.63)}{14.72 \text{ lb/min}} = -1.7\%$

H_2O $\frac{10.42 \text{ lb/min} - (6.73 \text{ lb/min} + 3.40)}{10.42} = 2.8\%$

N_2 $\frac{119.75 - (107.89 \text{ lb/min} + .79(18.37))}{119.75} = 2.2\%$

RFW 10-05-003/A-5/85

WESTON

SHEET 9 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.

PREPARED BY M. Coleman DEPT 1811 DATE 21 Sep 89 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

O_2 $\dfrac{(17.92\ lb/min) - (26.42 + .21(18.37) - .21(64.80))}{17.92\ lb/min} = 7.0\%$

Heat Balance Check

Heat Released by Fuel

$(4.13\ lb/min)(19,944\ BTU/lb) = 82,369\ BTU/min$

Heat Absorbed by F.C. exit gases

CO_2 $(2.63\ lb/min)(0.225\ BTU/lb\,°F)(1787-482\,°F) = 772\ BTU/min$

H_2O $(3.40\ lb/min)(0.478\ BTU/lb)(1787-482\,°F) = 2,121\ BTU/min$

N_2 $(107.9\ lb/min)(0.25\ BTU/lb)(1787-482\,°F) = 35,202\ BTU/min$

O_2 $(26.42 - .21(64.80))(.22\ BTU/lb\,°F)(1787-482\,°F) = 3,678\ BTU/min$

$(12.81\ lb/min)$

$41,773\ BTU/min$

Heat Absorbed by Combustion Products

CO_2 $(12.35\ lb/min)(0.225\ BTU/lb\,°F)(1787-70) = 4,771\ BTU/min$

H_2O $(1.63\ lb/min)(.478\ BTU/lb\,°F)(1787-70) = 1,338\ BTU/min$

$6,109\ BTU/min$

Heat Absorbed by Leak Air

Air $(18.37\ lb/min)(0.24\ BTU/lb\,°F)(1787-70) = 7,570\ BTU/min$

WESTON

SHEET 10 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE 21 Sep 84 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Radiation Losses

Surface Area

$\pi(5\,ft)(20\,ft) = 314\,ft^2$

Heat Lost

$(314\,ft^2)(2.8\,BTU/hr\,ft^2\,°F)(300\,°F - 70\,°F)(hr/60\,min) = 3,372\,BTU/min$

Total Losses

$(41,773\,BTU/min + 6,109 + 7570 + 3,372) = 58,824\,BTU/min$

Closure Balance

$$\frac{(82,369 - 58,824)}{82,369} = 28.6\%$$

WESTON

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24
TASK DESCRIPTION Test Run #2 Heat Balance TASK NO.
PREPARED BY M. Gimos DEPT 1211 DATE 2-3-89 APPROVED BY
MATH CHECK BY DEPT DATE
METHOD REV. BY DEPT DATE DEPT DATE

Gas Velocity in Air Preheater

$(18")(ft/12inch) = 1.5 ft$

$\pi/4\,(1.5ft)^2 = 1.767\ ft^2$

$(5533\ Acfm)/1.767 ft^2 = 3131\ fpm$

Gas Velocity in After Burner

$\pi/4\,(5ft)^2 = 19.63\ ft^2$

$(10,700\ Acfm)/19.63\ ft^2 = 545\ fpm$

∴ Assuming same size

$5533\ Acfm / 545\ fpm = 10\ ft^2$

$10 ft^2 = (\pi/4)(x\ ft)^2$

$x = 3.6\ ft\ \varnothing$

WESTON

SHEET 1 of 10

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-21

TASK DESCRIPTION Test Run #5 Heat Balance TASK NO.

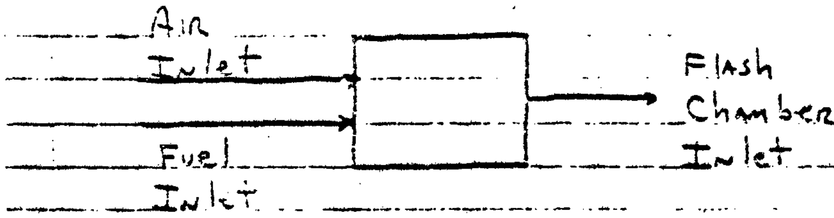
PREPARED BY M. Cosmos DEPT 1911 DATE 16 Feb 90

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE



Average Inlet Air Flow PI 202 1.11 ± .16 inws

Average Gas Pressure PI 310 2.47 ± .61 psig

Average Flash Chamber Inlet

1533 dscfm ± 3.8%

936 °F

4700 acfm

1.9 % CO_2

16.9 % O_2

81.2 % N_2

3.0 % H_2O

CO_2 (1533 dscfm)(0.019)(.11378 lb/ft³) = 3.31 lb/min

O_2 (1533 dscfm)(.0169)(.08275 lb/ft³) = 2.44 lb/min

N_2 (1533 dscfm)(.812)(.07240 lb/ft³) = 90.12 lb/min

H_2O $\frac{x}{1533+x}$ = .030

x = (47.41 cfm)(.04659 lb/scf) = 2.21 lb/min

117.08 lb/min

RFW 10-08-003/A-8/83

WESTON

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT 1311 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Correction to Gas Flow for altitude

correction = e (0.0000360286 (4520 ft)) = 1.176

design loc. = e (0.0000360286 (1750 ft)) = 1.066

density ratio = 1.176 / 1.066 = 1.103

Pgraph = (Density ratio)(Pact)

= 1.103 (2.47 psig) =

= 2.72 psig

From vendor graph 802 2.72 psig = 2.0 mm Btu/hr

(2,000,000 Btu/hr) / 2316 Btu/cf =

863 scfh = 14.39 scfm of propane

(14.39 scfm)(0.1196 lb/scf) = 1.72 lb/min

Combustion Air flow

Flow = 1433 + 406 (ln (1.11 ...)) = 1475 scfm

(1450 scfm)(.075 lb/scf) = 108.7 lb/min

moisture loading under worst observed

conditions 60°F = 0.01 lb H2O / lb d.a.

RFW 10-05-003/A-8/86

WESTON

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT. BH DATE 16 Feb 90 APPROVED BY

MATH CHECK BY ____ DEPT ____ DATE ____

METHOD REV. BY ____ DEPT ____ DATE ____ DEPT ____ DATE ____

Maximum water Load

$(108.7\ lb/min)(.01\ lb\ H_2O/lb\ gas) = 1.08\ lb\ H_2O$

Mass Balance Check

$$\frac{117.08\ lb/min - (1.72\ lb/min\ gas + 108.7\ lb/min + 1.08\ lb/min)}{117.08\ lb/min}$$

4.77% closure within measurement error

Combustion of Propane

CO_2	2.99	lb/lb gas
H_2O	1.63	lb/lb gas
N_2	12.07	lb/lb gas
Total	16.69	lb/lb gas $- 1\ lb\ gas/lb\ gas = 15.69\ \frac{lb\ air}{lb\ gas}$

Combustion of Fuel

CO_2 $(1.72\ lb/min)(2.99\ lb/lb) = 5.14\ lb/min$

H_2O $(1.72\ lb/min)(1.63\ lb/lb) + 1.08\ lb/min = 3.88\ lb/min$

N_2 $(1.72\ lb/min)(12.07\ lb/lb) = 20.76\ lb/min$

Excess Air

$(108.7\ lb/min) - (1.72\ lb/min)(15.69\ lb/lb) = 81.71\ lb/min$ XS Air

O_2 in XS Air $= (81.71\ lb/min)(.21) = 17.16\ lb/min$

WESTON

SHEET 4 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT. 1811 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Heat Balance

Heat Released by Fuel

$(1.72\ ^{lb}/_{min})(19{,}944\ ^{BTU}/_{lb}) = 34{,}303\ ^{BTU}/_{min}$

Heat Absorbed by Combustion Products

CO_2 $(5.14\ ^{lb}/_{min})(0.225\ ^{BTU}/_{lb\cdot F})(936\ ^\circ F - 70) = 1002\ \frac{BTU}{min}$

H_2O $(3.88\ ^{lb}/_{min})(0.478\ ^{BTU}/_{lb\cdot F})(936 - 70\ ^\circ F) = 1{,}606\ \frac{BTU}{min}$

N_2 $(20.76\ ^{lb}/_{min})(0.25\ ^{BTU}/_{lb\cdot F})(936 - 70\ ^\circ F) = 4495\ \frac{BTU}{min}$

xs Air $(81.71\ ^{lb}/_{min})(0.24\ ^{BTU}/_{lb\cdot F})(936 - 70\ ^\circ F) = 16{,}983\ \frac{BTU}{min}$

Total 24,086 BTU/min

Radiation Losses

$\pi(20\ inches)(\frac{1\ ft}{12\ inch})(6.5\ ft + 24.5\ ft) = 162\ ft^2$

$(162\ ft^2)(2.8\ ^{BTU}/_{hr\ ft^2\ ^\circ F})(300 - 70\ ^\circ F)(\frac{hr}{60\ min}) = 1{,}742\ \frac{BTU}{min}$

Heat Balance Comparison

$$\frac{(34{,}303\ ^{BTU}/_{min}) - (24{,}086\ ^{BTU}/_{min} + 1742)}{34{,}303\ ^{BTU}/_{min}} = 24.7\%$$

RFW 10-05-003/A-5/86

WESTON

SHEET 5 of 10

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT 1311 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Average Flash Chamber Outlet

2033 dscfm ± 5%
456 °F ± 70 °F
4133 acfm
1.5 % CO_2
17.7 % O_2
80.9 % N_2
2.9 % H_2O

CO_2 (2033 dscfm)(.015 CO_2)(0.11378 lb/cf) = 3.47 lb/min

O_2 (2033 dscfm)(.177 O_2)(0.0827 lb/cf) = 29.76 lb/min

N_2 (2033 dscfm)(.809 N_2)(.072 lb/cf) = 118.42 lb/min

H_2O $\frac{X}{2033 + X}$ = .029

X = (60.71 scfm)(.04654 lb/scf) = 2.83 lb/min

Total Exit Gas Mass Flow 154.48 lb/min

Leakage Estimate

$\frac{154.48 \text{ lb/min} - 117.08 \text{ lb/min}}{154.48 \text{ lb/min}}$ = 24.2%

Leakage Volume

154.48 lb/min - 117.08 lb/min = 37.4 lb/min

RFW 10-05-003/A-5/85

WESTON

SHEET 6 of 10

CLIENT/SUBJECT USATHAMA W.O. NO 2000-00-21

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO 2

PREPARED BY M. Cosmos DEPT 1811 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Heat Balance Around Flash Chamber

Heat Lost by Process Gas

CO_2 $\left(\frac{3.31+3.47}{2}\right)(0.225\ BTU/lb\cdot°F)(936-456°F) = 366\ \frac{BTU}{min}$

H_2O $\left(\frac{2.21+2.33}{2}\right)(0.478\ BTU/lb\cdot°F)(936-456°F) = 578\ \frac{BTU}{min}$

N_2 $\left(\frac{90.12+(119.42-.79(37.4))}{2}\right)(0.25\ BTU/lb\cdot°F)(936-456°F) = 10,740\ \frac{BTU}{min}$

O_2 $\left(\frac{21.44+(29.76-.21(37.4))}{2}\right)(0.24\ BTU/lb°F)(936-456) = 2,497\ \frac{BTU}{min}$

Total Heat Lost by Gas $= 14,181\ \frac{BTU}{min}$

Heat Absorbed by Leak Air

$(37.4\ lb/min)(0.24\ BTU/lb°F)(456-70°F) = 3465\ \frac{BTU}{min}$

Heat Lost Through Walls

$(14,181\ BTU/min) - 3465\ BTU/min = 10,716\ BTU/min$

$= 642,976\ BTU/hr$

WESTON

SHEET 7 of 13

CLIENT/SUBJECT USATHAMA W.O. NO. 2600-00-24

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE 24 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

Average Fuel Gas Pressure 6.26 psig ± .59

Average T.O. Exit Gas

2467 dscfm
1706 °F
12,617 acfm
6.3 % CO_2
10.8 % O_2
82.9 % N_2
8.4 % H_2O

CO_2 (2467 dscfm)(.063)(.11378 lb/dscf) = 17.7 lb/min

O_2 (2467 dscfm)(.108 O_2)(.08275 lb/dscf) = 22.0 lb/min

N_2 (2467 dscfm)(.829 N_2)(.07240 lb/dscf) = 148.1 lb/min

H_2O $\frac{x}{2467 + x} = .084$

x = (226 cfm)(.04654 lb/dscf) = 10.53 lb/min

198.3 lb/min

Gas Flow

P_{graph} = (1.103)(6.26 psig)

= 6.90 psig = 4,500,000 BTU/hr

RFW 10-05-003/A-5/86

WESTON

SHEET 9 of 10

CLIENT/SUBJECT USATHAMA W.O. NO. 2440-00-37

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO.

PREPARED BY M. Gunnoe DEPT 1311 DATE 24 Feb 90

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

(4,500,000 BTU/hr)/(2316 BTU/scf) = 1943 scfh

= 32.4 scfm

(32.4 scfm)(0.1196 lb/scf) = 3.87 lb/min

Air Leakage

198.3 lb/min − (154.5 lb/min + 3.87 lb/min) = 39.9 lb/min

= 20.1%

Combustion Products

CO_2 (3.87 lb/min)(2.99 lb/lb) = 11.57 lb/min

H_2O (3.87 lb/min)(1.63 lb/lb) = 6.31 lb/min

N_2 (3.87 lb/min)(12.07 lb/lb) = 46.71 lb/min

Air Consumed (3.87 lb/min)(15.69 lb/lb) = 60.72 lb/min

Mass Balance check

CO_2 $\frac{17.7 \text{ lb/min} - (11.57 \text{ lb/min} + 3.47 \text{ lb/min})}{17.7 \text{ lb/min}}$ = 15.0%

H_2O $\frac{20.53 \text{ lb/min} - (6.31 \text{ lb/min} + 2.83 \text{ lb/min})}{20.53 \text{ lb/min}}$ = 13.2%

N_2 $\frac{143.1 \text{ lb/min} - (118.92 \text{ lb/min} + .79(39.5 \text{ lb/min}))}{143.1}$ = −1.2%

WESTON

CLIENT/SUBJECT USATHAMA W.O. NO. 2030-00-24

TASK DESCRIPTION Test Run #5 Heat Balance TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE 24 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

O_2 $\frac{22.0 \text{ lb/min} - (29.76 \text{ lb/min} + .21(39.9 \text{ lb/min}) - .21(60.72 \text{ lb/min}))}{22.0 \text{ lb/min}}$

= −15.4%

Heat Balance Check

Heat Released by Fuel

$(3.87 \text{ lb/min})(19,994 \text{ BTU/lb}) = 77,378 \text{ BTU/min}$

Heat Absorbed by F.C. Exit Gases

CO_2 $(3.47 \text{ lb/min})(0.225 \text{ BTU/lb°F})(1706-456\text{°F}) = 976 \text{ BTU/min}$

H_2O $(2.83 \text{ lb/min})(0.478 \text{ BTU/lb°F})(1706-456\text{°F}) = 1691 \text{ BTU/min}$

N_2 $(118.42 \text{ lb/min})(0.25 \text{ BTU/lb°F})(1706-456\text{°F}) = 37,006$

O_2 $(29.76 \text{ lb/min} - .21(60.72))(0.22 \text{ BTU/lb°F})(1706-456\text{°F}) = 4677$

44,350 BTU/min

Heat Absorbed by Combustion Products

CO_2 $(11.57 \text{ lb/min})(0.225 \text{ BTU/lb°F})(1706-456\text{°F}) = 3254 \text{ BTU/min}$

H_2O $(6.31 \text{ lb/min})(0.478 \text{ BTU/lb°F})(1706-456\text{°F}) = 3770 \text{ BTU/min}$

7024 BTU/min

Heat Balance

Air $(39.9 \text{ lb/min})(0.24 \text{ BTU/lb°F})(1706-70\text{°F}) = 15,666 \text{ BTU/min}$

WESTON

SHEET 12 of 13

CLIENT/SUBJECT USETHAMA

W.O. NO. 7000-00-27

TASK DESCRIPTION Test Run of Heat Balance

TASK NO.

PREPARED BY M. Cusmos DEPT 1 DATE 24 Feb 96

APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

DEPT DATE

Radiation Losses

Surface Area $\pi(5 ft)(20 ft) = 314 ft^2$

Heat Losses

$(314 ft^2)(2.8 BTU/hr ft^2 °F)(300-70 °F)(hr/60min) = 3370 BTU/min$

Total Heat Losses

$(44,350 BTU/min + 7024 + 15,666 + 3370) = 70,410 BTU/min$

Closure Balance

$$\frac{(77,183 BTU/min - 70,410 BTU/min)}{77,183 BTU/min} = 8.8\%$$

RFW 10-05-003/A-5/86

WESTON

SHEET ___ of ___

CLIENT/SUBJECT ________ W.O. NO. ________

TASK DESCRIPTION ________ TASK NO. ________

PREPARED BY ________ DEPT. ________ DATE ________

MATH CHECK BY ________ DEPT. ________ DATE ________

METHOD REV. BY ________ DEPT. ________ DATE ________

APPROVED BY ________

DEPT ________ DATE ________

Heat Transfer Calculations

Test Runs 1

2, 3, & 5

RFW 10-08-002/A-5/86

WESTON

SHEET 1 of 5

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Insulation Calculations for Flash Chamber TASK NO. Sect II

PREPARED BY M. Cosmos DEPT. 1811 DATE

MATH CHECK BY DEPT. DATE

METHOD REV. BY DEPT. DATE

APPROVED BY

DEPT. DATE

Calculated Heat Losses from chamber Test 3

Tgas inlet = 947.3 data from thermocouples

Tgas outlet = 527.7

Average Gas Temperature = 737.5 °F

Wall Temperatures

Rear Wall	416.5
Rear Floor	350.8
Roof	527.7
Left Wall	524.6
Floor	335.7
Middle Wall	361.9

Average 419.5 ± 87 °F

Heat Transfer from Gas to Wall = Q_{GW}

$Q_{GW} = U_G A \Delta T_{GW}$

Heat Transfer in Wall = Q_W

$Q_{WA} = U_W A \Delta T_{WA}$

RFW 10-05-008/A-6/85

WESTON

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Insulation Calculations TASK NO.

PREPARED BY M. Camos DEPT 1811 DATE 24 Feb 90 APPROVED BY

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE DEPT DATE

$A = \pi D L + 2\left[\pi \frac{D^2}{4}\right]$

$= \pi(12.5\,ft)(35\,ft) + 2\left[\pi \frac{(12.5\,ft)^2}{4}\right]$

$= 1620\,ft^2$ inside surface area

$Q = 932{,}664\ \frac{BTU}{hr} = U_o\,(1620\,ft^2)(737 - 420\,°F)$

$U_{ow} = 1.82\ BTU/hr\,ft^2\,°F$

Calculations Composite Bldg Resistance

$Q = 932{,}664\ BTU/hr = \frac{k_a A_m}{L_a}\ (420 - 70\,°F)$

$A_m = \pi D_{avg} L + 2\left[\pi \frac{D^2}{4}\right]$

$= \pi\left[(12.5 + 21\,ft)/2\right](35\,ft) + 2$

$= 1842\,ft^2 + 245\,ft^2$

$= 2087\,ft^2$

$L_a = (D_o - D_i)/2$

$= (21.0 - 12.5\,ft)/2 = 4.25\,ft$

$932{,}664\ BTU/hr = \frac{k_a\,(2087\,ft^2)(420 - 70\,°F)}{4.25\,ft}$

$k_a = 5.43\ BTU/hr\,ft\,(F/ft)$

Combine conductivity of bldg

WESTON

SHEET 3 of 5

CLIENT/SUBJECT USATHAMA W.O. NO. 2000-00-24

TASK DESCRIPTION Insulation Calculation TASK NO.

PREPARED BY M. Cosmus DEPT. 1811 DATE 24 Feb 90 APPROVED BY

MATH CHECK BY DEPT. DATE

METHOD REV. BY DEPT. DATE DEPT DATE

Calculated Heat Losses from Flash Chamber Test 2

T_{gas} inlet = 733 °F

T_{gas} outlet = 391 °F

Average Gas Temperature = 733+391/2 = 562 °F

Wall Temperatures

Rear Wall	267
Rear Floor	255
Roof	314
Left Wall	397
Right Floor	212
Front Wall	271

Average 286 ± 63 °F

Heat Transfer To Wall from Gas

$Q = U_{gas} A_{wall} (\Delta T)$

594,202 BTU/hr = U (1620 ft²)(562 °F - 286 °F)

U = 1.33 BTU/hr ft² °F

594,202 BTU/hr = h_a (2087 ft²)(286 - 70 °F)

425 ft²

h_a = 5.60 BTU/hr ft² (°F/ft)

RFW 10-05-008/A-5/86

WESTON

SHEET 4 of 5

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Insulation Calculation TASK NO.

PREPARED BY M. Cosmos DEPT 1811 DATE 24 Feb 90

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Calculated Heat Losses from Flash Chamber T-5

T_{gas} Inlet = 893 °F

T_{gas} Outlet = 535 °F

Average Gas Temperature = 714 °F

Wall Temperatures

Rear Floor	392 °F
Rear wall	408
Right Floor	340
Left Wall	540
Roof	548
Middle Wall	361
Front Wall	343

Average 376 ± 163 °F

Heat Transfer To Wall From Gas

$Q = U_{gas} A_{wall} \Delta T$

$642{,}976\ \text{BTU/hr} = U_{gas}\,(1620\ \text{ft}^2)(714-376\ °\text{F})$

$U_{gas} = 1.17\ \text{BTU/hr ft}^2\ °\text{F}$

$642{,}976\ \text{BTU/hr} = h_a\ \dfrac{(2087\ \text{ft}^2)(376-70\ °\text{F})}{4.25\ \text{ft}^2}$

$h_a = 4.28\ \text{BTU/hr ft}^2\ (°\text{F/ft})$

WESTON

SHEET 5 of 5

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Insulation Calculations TASK NO.

PREPARED BY M. Cosmos DEPT 1891 DATE 24 Feb 90

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Test T-2

Gas Velocity in Chamber

(4400 wacfm + 3917 wacfm)/2 = 4159 wacfm

Area = $\pi D^2/4 = \pi(12.5 ft)^2/4 = 123 ft^2$

velocity = 4159 / 123 ft^2 = 33.9 fpm

Test T-3

(5533 wacfm + 3900 wacfm)/2 = 4717 wacfm

velocity = 4717 wacfm / 123 ft^2 = 38.3 fpm

Test T-5

(4700 wacfm + 4133 wacfm)/2 = 4417 wacfm

velocity = 4417 wacfm / 123 ft^2 = 35.9 fpm